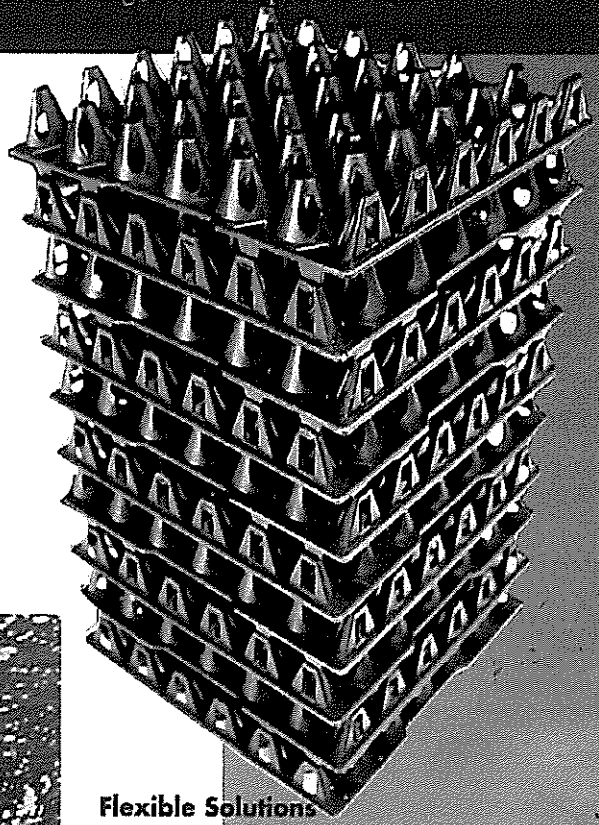
Total Waste Water Treatment Solutions

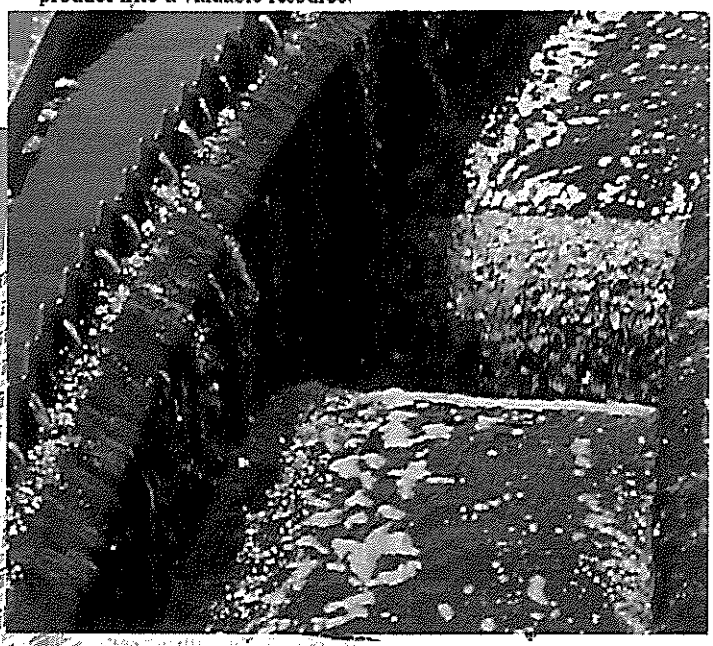
BioSystems Limited provides environmentally-friendly, total waste-water treatment solutions. Working with our clients we provide consultancy for turn-key systems incorporating feasibility studies, evaluations, and problem solving on a site specific basis.



Safe and Natural Solutions

Water and pollution are two of the biggest concerns facing our planet today. As urban development increases, there is mounting pressure on developers to address environmental concerns and find natural, safe solutions for waste water treatment. BioSystem provides such a solution through the application of one of the world's leading bio-technologies.

BioSystem provides a modular packaged waste water treatment plant. The treatment process incorporates an enclosed biofilter made of a polypropylene media which does not require replacement and is designed to be non-clogging. Combined waste water from kitchen and ablutions are subjected to three stages of bacterial digestion before clarifying and disinfecting for final effluent. The effluent can be used for irrigation, turning a waste product into a valuable resource.



Flexible Solutions

The BioSystems plants are capable of serving 10-person domestic units up to 20,000-person urban communities. Difficult or distant sites present no problem, and the modulated, in situ design makes use of local building materials where available. The plants can be architecturally designed to blend into the development theme. Commercial applications include hospitality and food processing industries, refineries and engineering companies.

Product features

Modular system
Sealed system
Compact system
Operates in temperatures from -20 to 50C
Chemical free system
Uses existing components
Low electro mechanical components
Non-biodegradable, polypropylene media
BOD levels of between 10mg/l and 30mg/l
Fully automatic system

Benefits

Plant capacity easily increased
Odorless, noiseless, flyless
Minimal usage of land (0.06 to 0.09 m2/p.e.)
Suitable for all climates
Meets WHO standards for irrigation
Cost effective, easy to install
Low power consumption, low running cost
Indefinite life span, 100% clog free system
Efficient BOD reduction
Low maintenance, skilled operator not required

BIOSYSTEMS

PACMEDIA™

Biological Wastewater Treatment Media

BIOSYSTEMS
LIMITED
Specialist in Water Technologies

For	:	**James Cubitt Architects Pty. Ltd**	**August 2005**
Attention	:	**John Nankervis**	
From	:	**Mark Campbell**	
Subject	:	**Sewage Treatment Plant 24 Bed Hospital**	
Quote No.	:	**C/206**	

SEWAGE TREATMENT PLANT

Dear Sir,

We have pleasure in submitting our proposal and formal quotation to Design, Supply and Assemble (Install) a 150 EP Series BioSystems Sewage Treatment Plant System for **24 Bed Hospital**. Formal design drawings will be submitted once the quote is accepted and an order placed.

Data Input Project Information:

Further to our meeting regarding design loading for STP Data i.e.:

1.	Total number of Hospital Beds	24 Beds
2.	Number of Day Staff	30 t0 50 Approx.
3.	Number of Resident Staff	NA
4.	Number of Day Visitors Peak	Peak 100
5.	Special Function Room	NA
6.	Kitchen garbage grinder	NA
7.	Dishwasher	NA
8.	Laundry	Yes (Balance Tank design)
9.	Does any trace waste enter the system	Yes, HospitalCOD Waste
10.	Existing systems and tanks	New Plant
11.	Effluent disposal methods	Irrigation or water course
12.	Restaurant meals per day	As above
13.	Is a grease trap fitted	Yes to BioSystems design

1.1 WE ARE QUOTING AS FOLLOWS (SCOPE OF WORKS)

To supply and assemble (Install) a BioSystems Biological Sewage Treatment Plant from the incoming connection to the treated water overflow, **excluding the civil construction of the concrete tanks.**

We will include the following for the Sewage Treatment Plant:

(1) Supervision during construction phase and all engineering drawings (not including civil engineering calculations and drawings)
(2) Supply and Assemble (Install) PVC Dip Pipe connections for P1, Clarifier, Biofilter, Final Effluent Tank, Incoming effluent and Outgoing treated overflow.
(3) Supply and Assemble (Install) Pumps, Controllers, Alarms.
(4) Supply and Assemble (Install) Auto desludging pump, PVC pipework and connections in the clarifier tank.
(5) Supply and Assemble (Install) biofilter dispersion system over the filter media
(6) Supply and Assemble (Install) the forced draft fan and controls in the biofilter
(7) Supply and Assemble (Install) the electrical control panel for the complete BioSystem STP.
(8) Supply and Assemble (Install) the manual Chlorinator Unit for the final effluent tank
(9) Budget price to ship one 20 feet container to site for all M&E equipment for STP System
(10) Commissioning of plant. Specialist labour personnel include accomodation messing & air-fares
(10) Preventative maintenance by us for the first 3 months with periodic visits to the site.
(11) A 3 years defects liability period on all supplied components, PVC, media, electrical conducts, etc.
(12) Training: On Completion, BioSystems Limited will supply 2 (two) copies of the Operation and Maintenance manual.

Note : Biosystems will train a local personnel to provide the ongoing maintenance.(See monthly check sheet attached)

1.2 EXCLUSIONS

(a) Connection of influent line to our primary tank connection.
(b) Power supply to plant control box, including termination onto our main switch.
(c) Excavation and backfill.
(d) Civil engineering and construction.
(e) Architectural Enhancements
(f) The Final Effluent Pump needs to be sized for the broadcast irrigation system

1.3 QUOTED PRICE BUDGET **US$ 65,000 + PPN**

Mechanical, Electrical,Llabour, Transportation.

This quoted price is valid for 60 days from above date.

1.4 PAYMENT TERMS AND CONDITIONS

- 40% of quoted price with official order.
  (To sub assemble components and order specialised filter media).
- 50% of quoted price on the ordering and supply of the Pumps, Electrical wiring, Control panel and all other equipment to complete the system.
- 10% of quoted price within 7 days of written advice that final commissioning of plant has been carried out.

1. 5 SPECIFICATION (SEWAGE TREATMENT PLANT & TANK SYSTEMS)

We estimate requirements as below:

(a) Nature of waste - water : Domestic

(b) Influent BOD5 (Average) : 300 ppm

(c) Influent TSS (Average) : 300 ppm

(d) Treatment process : BioSystems Biological Forced Draft High Rate Trickling Filter

(e) Design Series : 150 EP Series

(f) Daily average waste-flow : 18 m^3/day

(g) Units required : 1 (One) Single System

(h) Plant organic load : 7.0 Klg BODs / day

(i) Final Effluent COD : < 50 ppm

(j) Final Effluent BOD : < 20 ppm

(k) Final Effluent TSS : < 30 ppm

(l)	Primary 1&2	Type : Concrete Tank	Capacity :	
(m)	Balance Tank	Type : Concrete Tank	Capacity :	
(n)	Dissolve Oxygen	Type : Concrete Tank	Capacity :	TBA
(o)	Clarifier	Type : Concrete Tank	Capacity :	
(p)	Final Effluent	Type : Concrete Tank	Capacity :	
(q)	Media	Type : Polypropylene	Capacity :	

The system can be designed to fit in with the development. Changes to the outside design should be discussed prior to final drawings with the approval of owner. The civil design and construction of the concrete tanks is not by BioSystems. BioSystems will supply basic dimension of tanks and drawings of blockouts required for the subsequent installation of pipes, conduits and hatches.

1.6 ESTIMATED COMPLETION PERIOD (DEPENDING ON CIVIL CONSTRUCTION SCHEDULE)

(a) Mobilization : 3 weeks from date of confirmation order

(b) Sub assembly : 6weeks from date of possession of site

(c) Site testing : 2 weeks immediately upon completion of installation

Due to the mobilization and site clearing in placing the STP System, the time given for completion would be a total 11 weeks.

1.7 WARRANTY PERIOD MECHANICAL AND ELECTRICAL

The warranty of our system shall be classified as follows:

(a) Civil Structure (will be warrantied by others)

(b) Electrical/mechanical equipment - 1 year as per separate manufacturers' warranty.

The above warranty covers material defects and performance criteria as per the data sheet supplied. (See warranty clause (w) of the components section). The Contractor warrants to repair or replace any defect of defective component, electrical or mechanical component which is subject to a separate BioSystems warranty, for a period of 24 months after the date of commissioning. Such warranty is subject to the client notifying the supplier of any defect within 48 hours of the client becoming aware of the defect.

1.8 WARRANTY/GUARANTEES PROCESS PERFORMANCE

The Biofilter Package Sewage Treatment Plants will be designed to produce a maximum discharge effluent quality of **BOD 20 milligrams per litre BOD5 and TSS 30 milligrams per litre of total suspended solids** subject to the design loadings specified and the client being responsible for the weekly maintenance identified in the attached operations manual and the supplier carrying out monthly maintenance or in accordance with requirements identified in the Operations and Maintenance Agreement supplied on completion of STP system.

Ancillary Advice

BioSystems will assess the chemicals used on the premises and other cleaning activities which could harm the bacterial process of the facility. We highly recommend the use of environmental products, BioSolve/BioCept is a product (liquid bacteria) designed to prevent the problem associated with grease, blockages, blocked drains and precondition the waste prior to entering the plant. (See separate data sheet)

We are sure that our system will satisfy your requirements and we look forward to hearing from you in due course. Should you require any further information or wish to clarify any particular points in our quotation please do not hesitate to contact the undersigned.

Yours faithfully,

Mark Campbell
Managing Director

BIOSYSTEMS **PACMEDIA™**
Biological Wastewater Treatment Media

Modular Biomedia for Wastewater Treatment

History

For over 100 years the fixed film reactor (trickling filter) has been used in waste water treatment to reduce the biochemical oxygen demand (BOD) and for nitrification. As the wastewater passes down through the trickling filter, microganisms on the surface of the media convert the dissolved organic wastes and ammonia nitrogen into stable by-products - carbon dioxide,nitrates, nitrites and biosolids which are removed by clarification.

Advantages

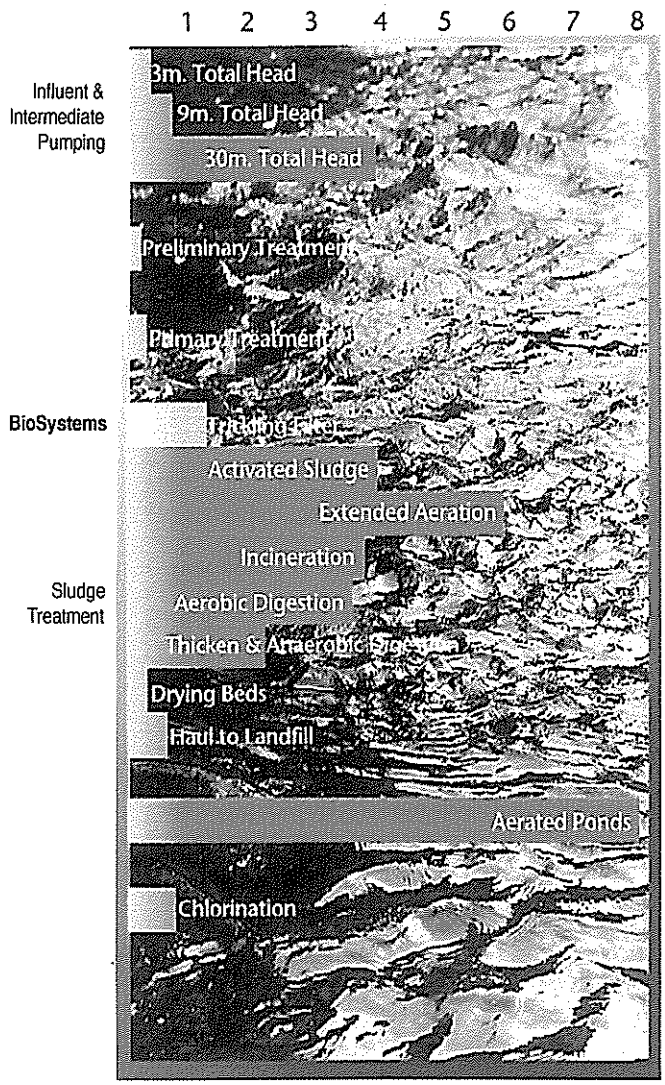
The advantage of the trickling filter process over other methods of treating wastewater include ;

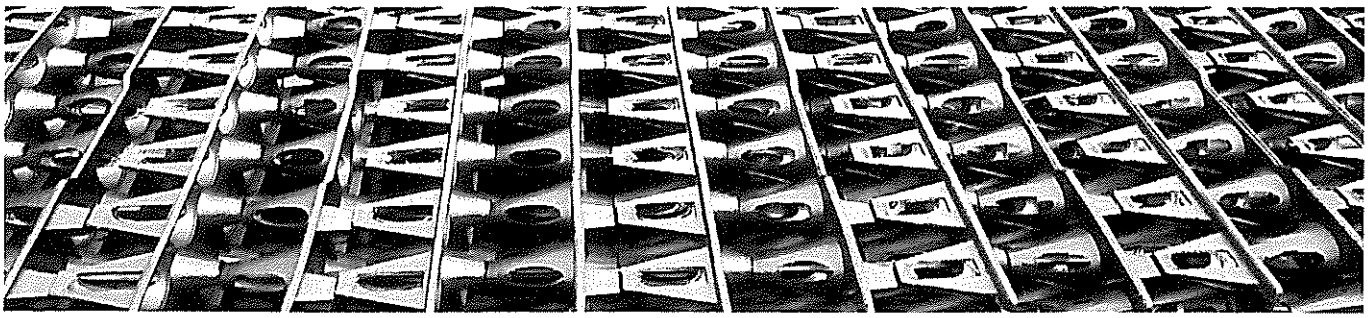
1. Lower energy consumption
2. More resistant to hydraulic and organic shock loads
3. Unsophisticated operational procedures
4. Fewer personnel required
5. Reduces sludge bulking problems

Future

With the advent of the highly efficient modular cross fluted media, the trickling filter must be considered as a viable alternative for complete secondary treatment and nitrification of municipal wastewater. As energy and labour costs continue to increase, the trickling filter process will continue to play an important role in wastewater treatment.

Relative Energy Consumption



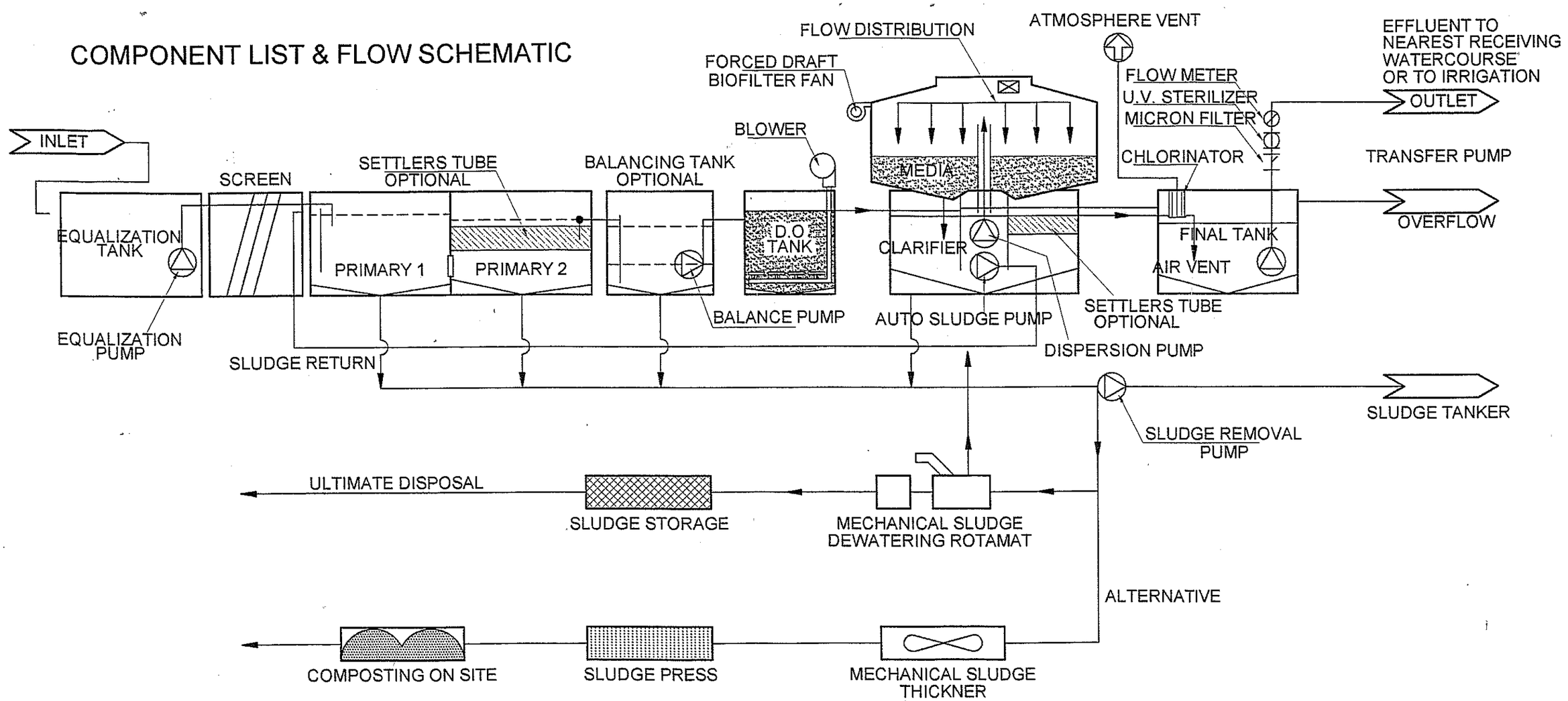


PERFORMANANCE DATA CAPACITY

Stage	Treatment Process	Function
Pretreatment or Primary Treatment BOD Reduction 30% Suspended Solids 70%	1. Primary Screen	Remove inorganic solids
	2. Equalisation Tank	Equalise Flow
	3. Primary Sed 1	Remove settleable solid/material
	4. Primary Sed 2	Secondary settleable solid removal
	5. Tube Settler Media	Improve primary clarifier settleability (OPTIONAL)
	6. Balance Tank	Balance prior to clarifier
	7. DO. Tank	Precondition super nathan liquor effluent prior to entering the clarifier
Secondary Treatment BOD Reduction 70% Suspended Solids Reduction 30%	8. Clarifier	Separates treated effluent and settled sludge
	9. Tube Settler	Improve secondary clarifier performance
	10. Forced Draft Fan	Main air supply for the Biofilter process
	11. Biofilter Unit	Removes major pollutants BOD
Tertiary Treatment	12. Disinfection	Destruction of disease-causing organism
	13. Flow Meter	Measure and record flow (OPTIONAL)
	14. Final Effluent	Can be used for pumping or tertiary final clarifier or final effluent storage
Sludge/Solids Holding	15. Thickner Stabilisation Dewatering Holding	Convert sludge to a form suitable for ultimate disposal, various option available

FORCED DRAFT HIGH RATE TRICKLING FILTER

COMPONENT LIST & FLOW SCHEMATIC



Drawing Passed by :
Date :

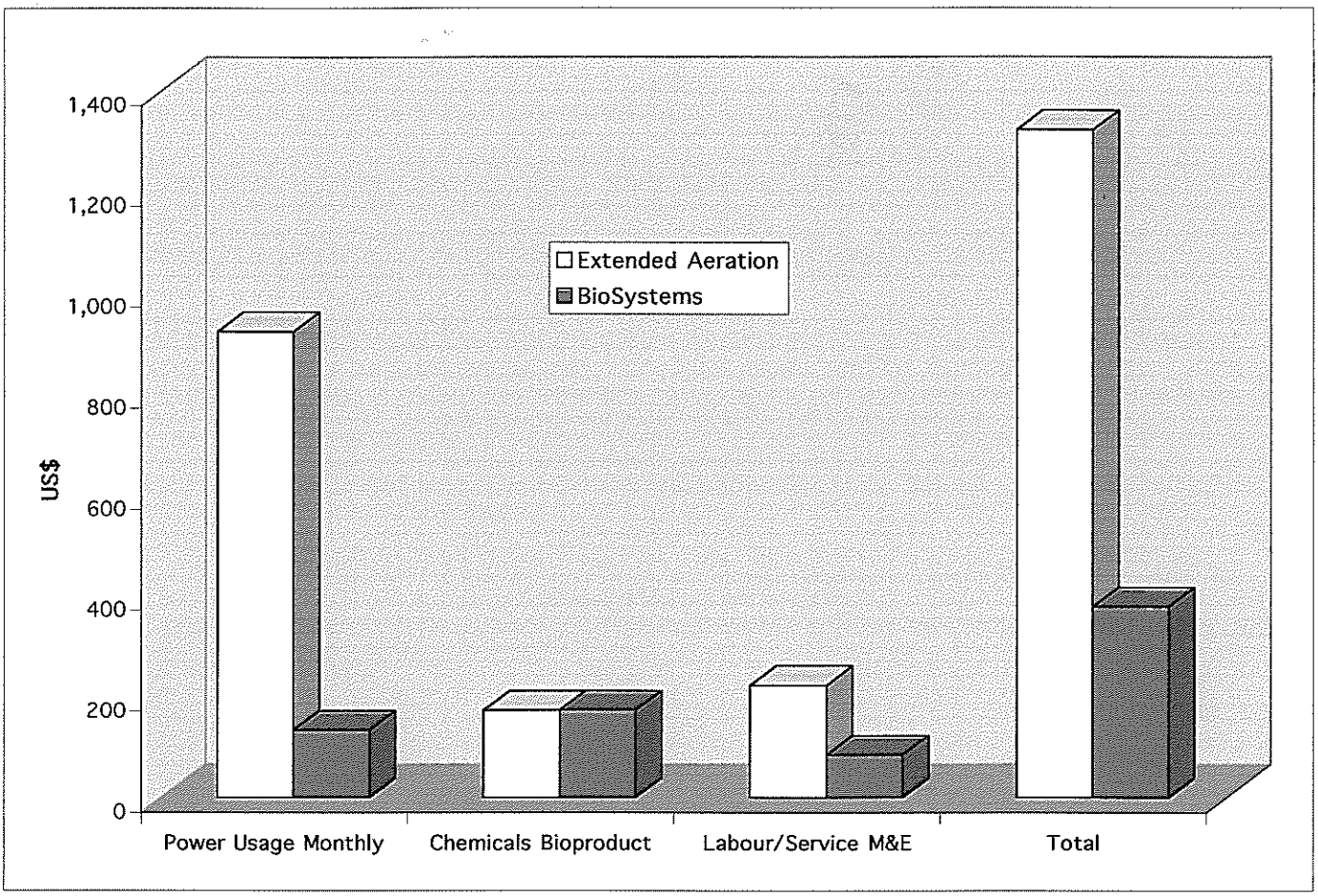
BioSystems Limited Tel. 361-281969 Fax. 361-271454	Project :	Drawing : Schematic Diagram Only	Drawn by : M. Campbell
	Date : / Scale : NOT TO SCALE		Checked :

BIOSYSTEMS LIMITED

PENINSULA BEACH RESORT BALI

Example Only

MONTHLY ELECTRICAL COST COMPARISON GRAPH
300 PERSON SYSTEM



Based on 100m3 day
US$ 0.067 per KWH

BioSystems Cost Comparison Electrical Supply

Pumps/Blower	KWH hour	US$ 0.067 /KWH	Hour/day	KWH/day (US$)	KWH/day (US$)	KWH/year (US$)
Blower 0.5 hp	2.75	0.067	12	2.21	66.33	795.96
1 x Fan	0.25	0.067	24	0.40	12.06	144.72
Dist. Pump	1.1	0.067	24	1.77	53.06	636.77
				Per Month	131.45	
					Total PA	1,577.45

Extended Aeration Cost Comparison Electrical Supply

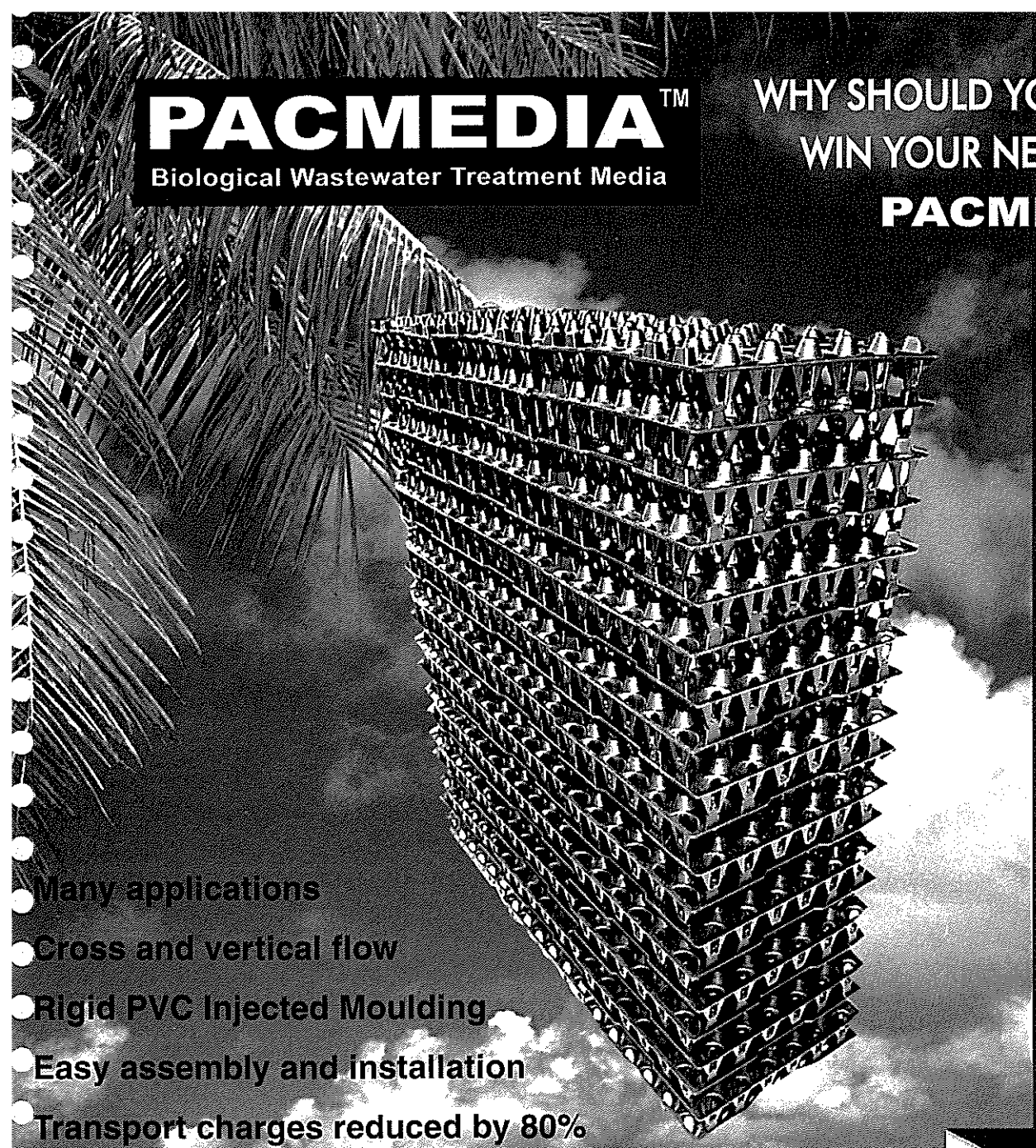
Pumps/Blower	KWH hour	US$ 0.067 /KWH	Hour/day	KWH/day (US$)	KWH/day (US$)	KWH/year (US$)
2 x Blowers 5.5 hp	15	0.067	24	24.12	723.60	8,683.20
1 x Fan 1.1 hp	1.5	0.067	24	2.41	72.36	868.32
2 x Rec. Pump 1.1 hp	5.4	0.067	12	4.34	130.25	1,562.98
				Per Month	926.21	
					Total PA	11,114.50

PACMEDIA™

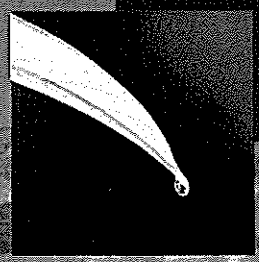
Biological Wastewater Treatment Media

WHY SHOULD YOU PAY MORE ?
WIN YOUR NEXT BID WITH
PACMEDIA

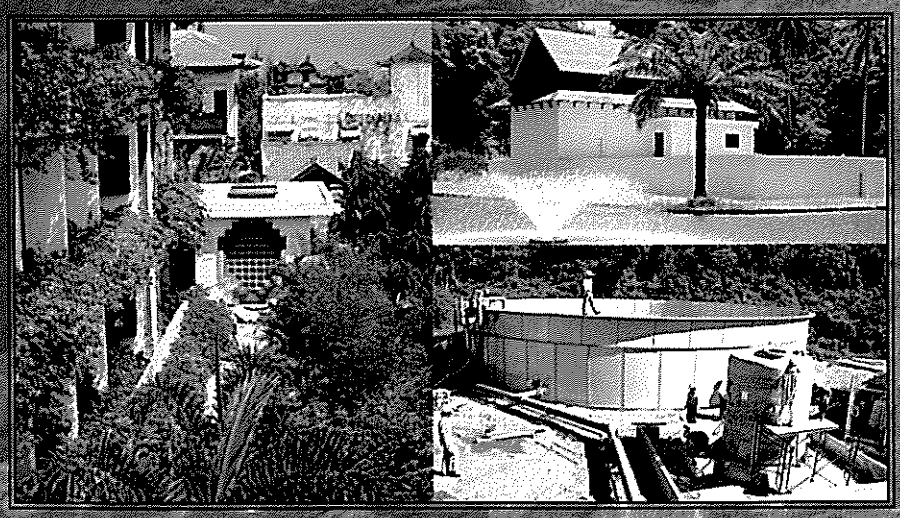
BIOSYSTEMS
LIMITED



- Many applications
- Cross and vertical flow
- Rigid PVC Injected Moulding
- Easy assembly and installation
- Transport charges reduced by 80%



WATER TREATMENT SOLUTIONS



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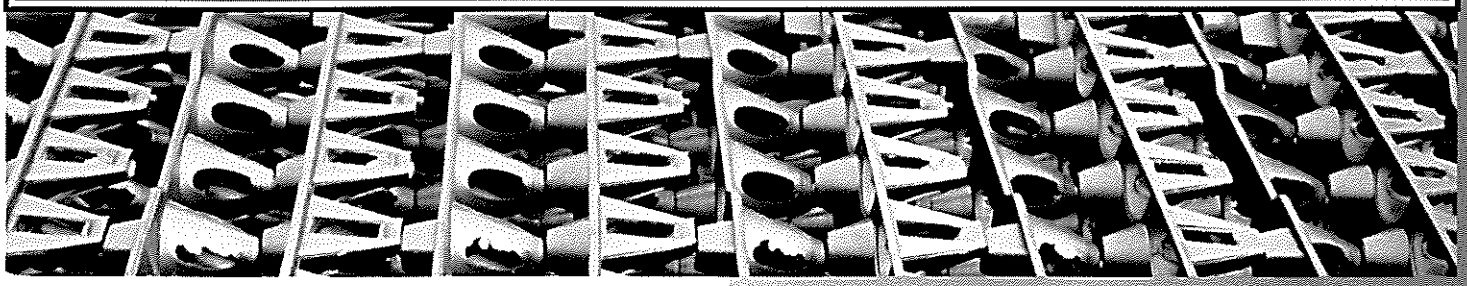
PACMEDIA™

Biological Wastewater Treatment Media



MODULAR BIOMEDIA FOR WASTEWATER TREATMENT

MEDIA BACKGROUND

For many decades, the fixed film biofilter (commonly referred to as a trickling filter) has been a widely applied method for the biological oxidation of organic wastes. Biological growth on the media surface converts dissolved organic waste material or ammonia nitrogen into stable by-products including carbon dioxide, nitrates, nitrites, water and biological solids which are later removed by clarification.

In an effort to increase the efficiency of the fixed film biofilter, various synthetic media have been developed.Unique among these, is **PACMEDIA** a modular cone fluted media, manufactured by BioSystems initially for their design built wastewater treatment plants through out South East Asia.

DESCRIPTIONS

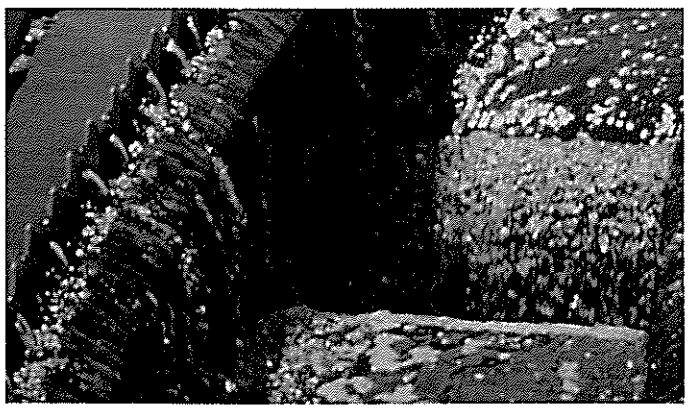
BioSystems' modular self-supporting **PACMEDIA,** is fabricated from rigid Injected Molded PVC. Each mould is assembled to on interlocking pattern with adjacent moulds. This configuration provides continuous and uniform horizontal and vertical redistribution of both air and water throughout the full depth of the media. All the media surface is located in a direction which ensures no unused "undersides" and the unique raised fluted cones allowing for proportion of vertical and horizontal flow has eliminated the risk of clogging.

ADVANTAGES

The advantages of the fixed film biofilter over other methods of treatment include :

- **Low energy consumption**
- **Reliable performance**
- **High resistance to hydraulic and organic shock loads**
- **Simple and unsophisticated operational procedures**
- **Effective land utilization**
- **Reduced sludge bulking problems**

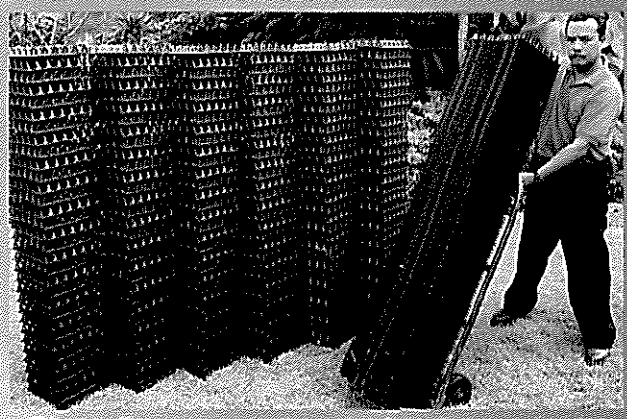
The fixed film biofilter is, therefore, a very cost-effective method for BOD (Biochemical Oxygen Demand) reduction, nitrification, denitrification, odor scrubbing and anaerobic treatment.



SPECIFICATIONS PACMEDIA :

- **PACMEDIA surface area 140 m2/m3, void 95%**
- **Polypropylene Injected Molded PVC sheets**
- **Sheet size 300 x 300 comprising 42 raised corner at 70° and locating lugs for assembly**
- **Shipping in 1 x 20 lt. container can accommodate 170 m3 of PACMEDIA `in pack down form**
- **Transport volume and freight charges are reduced by 80%**
- **Fast and simple installation thanks to easy handling of the PACMEDIA modules.**

All of the **PACMEDIA** supplied by BioSystems is UV protected, resistant to rot, fungi, bacteria, acids and alkalies as commonly found in wastewater treatment.



Biomedia can pack down to 1 trolley on right.

APPLICATION

Modular PACMEDIA has numerous applications in wastewater treatment.

The more typical application include :

- **Industrial Waste**
- **Municipal Waste**
- **Polishing Treatment**
- **Replace Rock Media**
- **Nitrification**
- **Denitrification**
- **Odor Scrubbing**
- **Cooling Towers**

Distributor :

For more information on PACMEDIA for a specific application please contact BioSystems Limited.

PT.BIOSYSTEMS INDONESIA
Jl. Pungutan No. 53B, Sanur – Bali 80228
Telp: 62 361 281969 Fax : 62 361 271454 Email : bsl@indo.net.id

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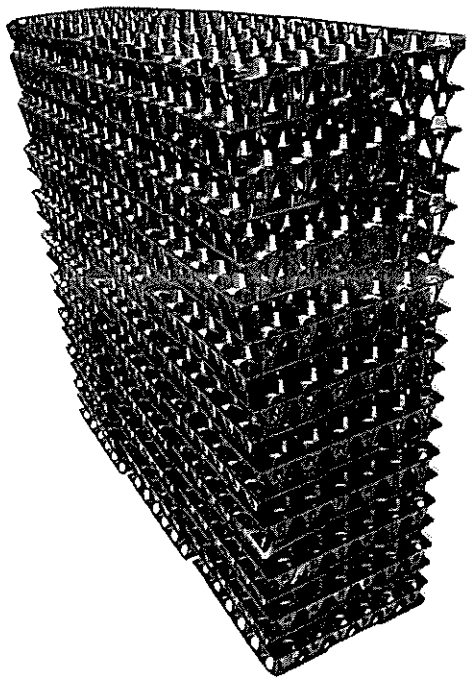
PACMEDIA™

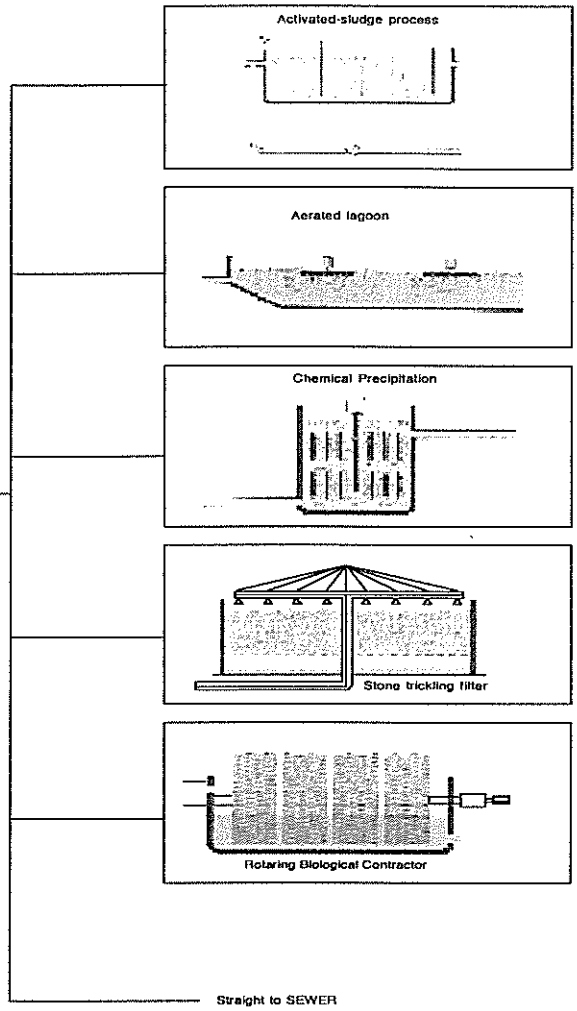
Biological Wastewater Treatment Media

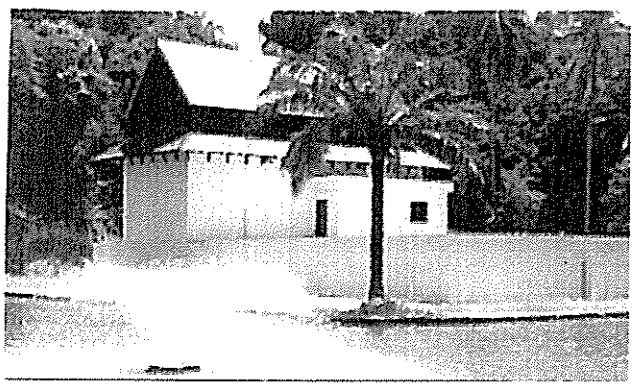
CAN BE USED IN ANY COMBINATION

The modular **PACMEDIA** can be incorporated in a wide range of different treatment systems. It can be used both in new installations and as means of increasing the capacity of existing effluent treatment plants.

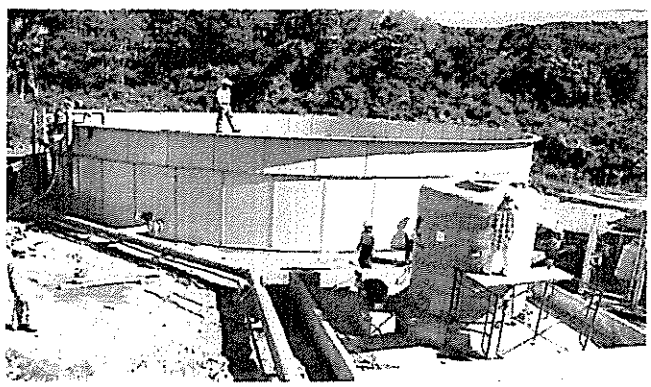


MODULAR **PACMEDIA**





PACMEDIA 5000 EPPLANT TRICKLING FILTERS STP



2000 EP PLANT SUBMERGED PACMEDIA EXTENDED AERATION PLANT

BIOSYSTEMS

PT. BIOSYSTEMS INDONESIA

Jl. Pungutan No. 77, Sanur, Bali 80228

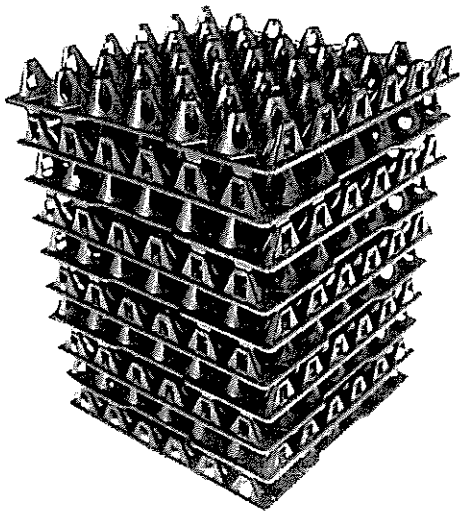
Telp. +62 361 281969 Fax. +62 361 271454 Email: bsl@dps.centrin.net.id

Website : www.modularpacmedia.com

BIOSYSTEMS **PACMEDIA™**
Biological Wastewater Treatment Media

BIOSYSTEMS HIGH EFFICIENCY PACMEDIA

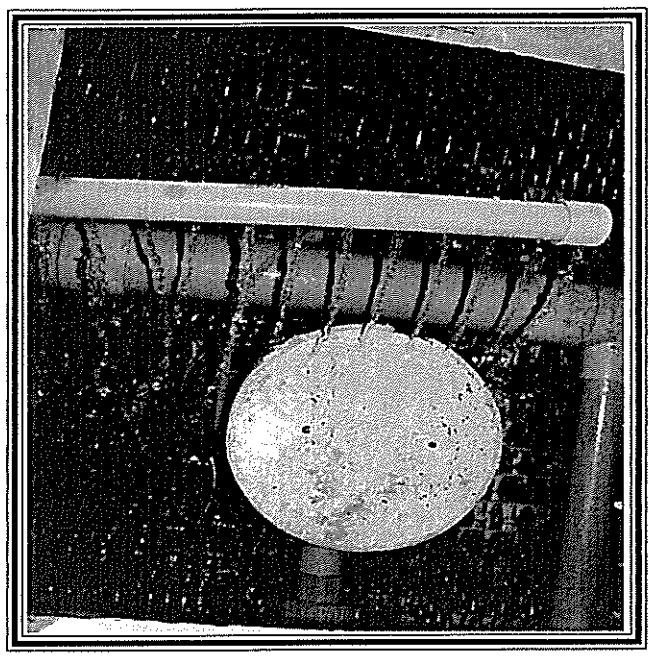
Biological treatment of waste water is based on a close interaction between water, air, and micro-organisms. One factor governing the performance of a Biofilter is therefore to provide a large contact area between the above components.



What takes place in a Biofilter is a process of biological oxidation. A growth of bacteria and other micro-organisms becomes established on the surface of the medium. Here they feed on the organic pollutants in the waste water and, with the aid of the oxygen in the air, they convert the pollutants into harmless by-products. The configuration of the Biofilter Media is such that it induces the waste water to flow uniformly over the available surface of the biological growth in a thin turbulent film, promoting the maximum rate of transfer of substrate and oxygen to the microbical film.

INDEPENDENT OF IRRIGATION SYSTEM

BioSystems' modular self-supporting media, is fabricated from rigid Injected Moulded PVC sheet. Each mould is assembled to on interlocking pattern with adjacent moulds. This configuration provides continuous and uniform horizontal and vertical redistribution of both air and water throughout the full depth of the media. All the media surface is located in a direction which ensures no unused "undersides" and the unique raised connes allowing for proportion of vertical and horizontal flow, has eliminated the risk of clogging.



The system of interconnected channels makes it possible to use any kind of irrigation system, whether it is a rotating distributor or a fixed system. The internal distribution system inside the Biofilter starts to operate immediately the waste water hits the media layers. The water will flow in a vertical and horizontal direction through the media flow to split when passing over the fluted cones through the media.

The interconnected channels also form numerous contact points between the surfaces.The liquid film is broken up and remixed, a turbulence of vital importance for efficient transfer of oxygen and dissolved organic matters between the liquid and the biomass.

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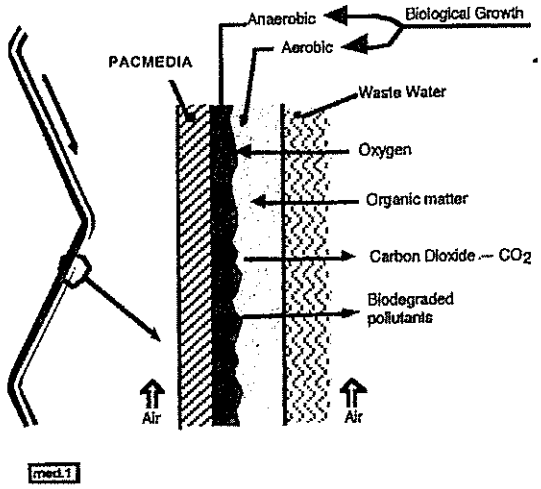
PACMEDIA™
Biological Wastewater Treatment Media

CROSS SECTION OF PACMEDIA

A magnified view of a surface layer shown in cross-section



med.1

The thickness of the layer of biological growth varies with the type of waste water being treated and the rate of input. When the layer reaches a certain thickness it sloughs off and is carried out with the flow of water. Immediately a new layer of micro-organisms starts to build up again.

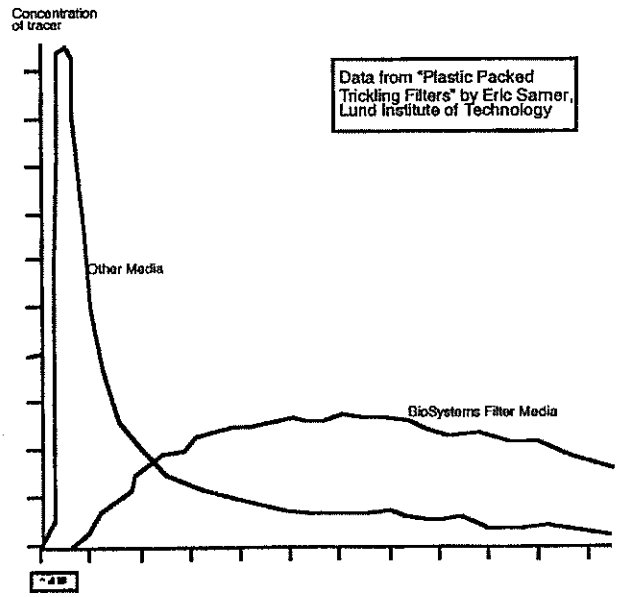
The mixture of treated water and entrained sludge is collected at the bottom of the **PACMEDIA** and routed away for further treatment.

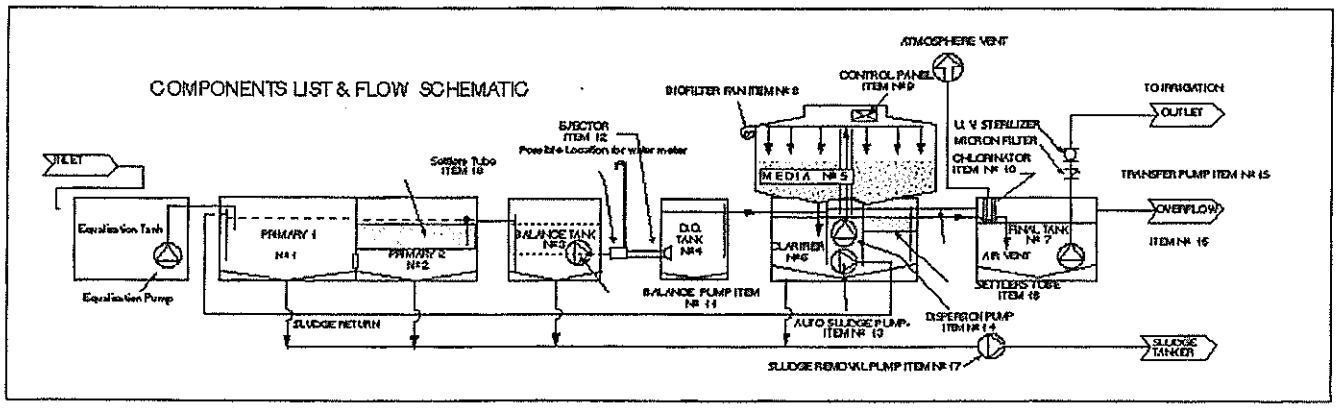
With its cross-flow configuration, there is a minimal pressure drop so that adequate aeration occurs by forced draught ventilation.

LONG RETENTION TIME

The efficiency of a **PACMEDIA** can be assessed by measuring the retention time, i.e. how long it takes for a specified volume of water to pass through it. The graph shows the results of a test in a Biofilter, 3 metres high. A curve for a similar Biofilter medium without the cross-flow configuration is given as a comparison.

With Biosystems's media the retention time is considerably longer.

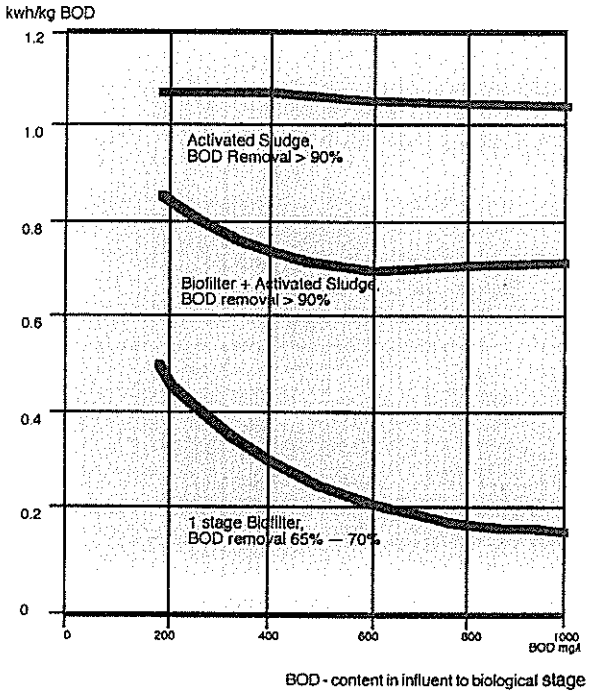




BioSystem's plant incorporating PACMEDIA

BIOSYSTEMS **PACMEDIA™**
Biological Wastewater Treatment Media

LOW ENERGY CONSUMPTION



The only energy needed to run the Biosystems' biofilter is that for pumping the waste water over the Biofilter in conjunction with a energy efficient forced draft fan. For a standard distribution system, this power consumption does not exceed 15 - 30 W/m³ of Biosystems' media, equal to 0.17 - 0.50 kWh/kg BOD removed. The variation is due to individual process designs, type of waste water and the maximum BOD concentration allowed in the plant outlet. The graph shows some typical data from Biosystems Biofilters.

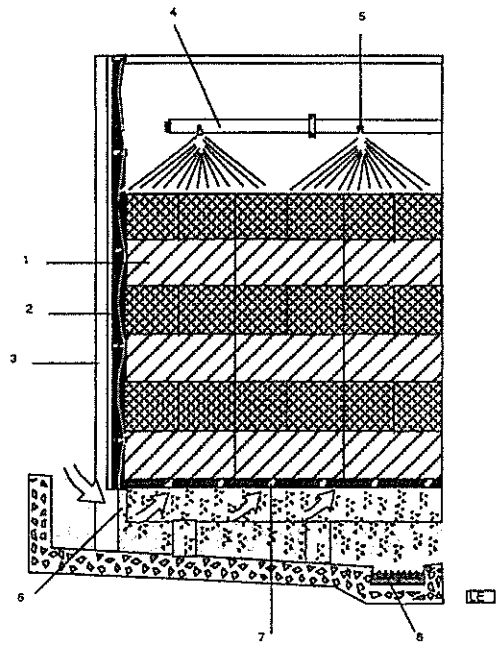
On request we will make a computer calculation on the energy consumption for your specific plant.

LOW CONSTRUCTION COSTS

The media is self-supporting, strong and can easily be cut to fit into any surrounding structure. As no pressure occurs on surrounding walls, these can be of a very simple and therefore cheap construction. The figure shows an example.

The media is also ideal for refurbishing of old rock-media trickling filters. The capacity and effluent quality will be considerably improved and operation/maintenance simplified.

1. Biofilter medium - every second layer is turned 90°
2. Inner liner - to segregate effluent from tower structure.
3. Exterior cladding.
4. Distribution pipe.
5. Nozzles.
6. Air inlets - approximately 4 - 6% of cross sectional area of the Biofilter.
7. Support system - wide beam type.
8. Drainage channel - central or peripheral.

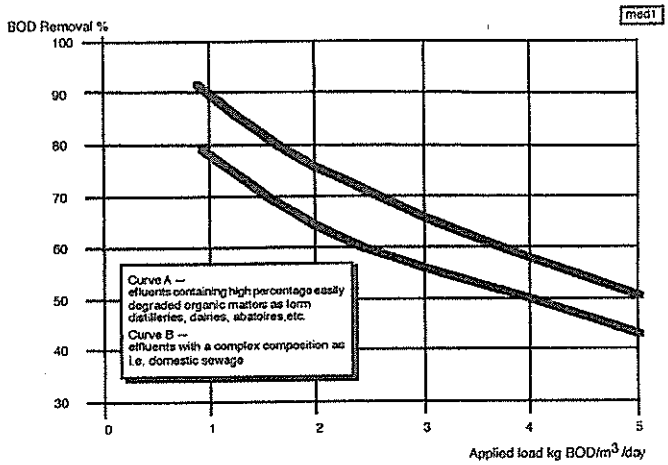


DESIGN CONDITIONS

BOD-REDUCTION

In biological treatment of wastewater many parameters, such as BOD-concentration, origin of the waste water, temperature, pH and nutrient balance, interact in such a way that each plant must be designed individually. Based on empirical data collected during years of experience, Biosystems' process design department assists clients to design Biofilters with optimum performance and economy.

Biosystems' filters are designed for a wide variety of application, covering the full field from high-rate Biofilters for partial treatment of industrial wastes to full secondary treatment of municipal sewage.



HYDRAULIC LOAD

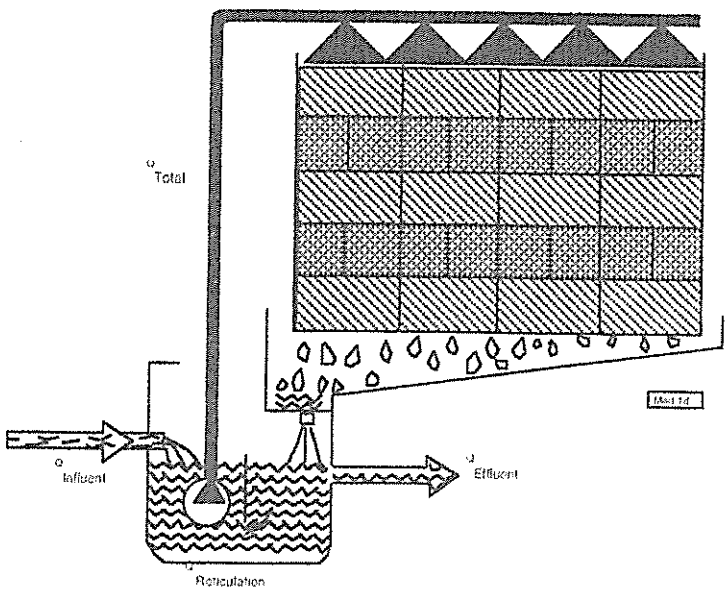
To utilize fully all the available surface area of the Biofilter media, a minimum amount of water must be fed to the Biofilter, i.e. a minimum hydraulic load of waste water per square metre of top layer surface, per hour, $m^3/m^2/h$. This water also helps to flush out the biological sludge.

$$\text{Hydraulic Load} = \frac{Q_{Total}}{\text{Area}}$$

$$Q_{Total} = Q_{Influent} + Q_{Reticulation}$$

Normally no recirculation is necessary due to the high efficiency of Biosystems' biofilters, but for some very high concentrated waste water, recirculation is necessary to reach the minimum hydraulic load without exceeding the organic load for which the Biofilter is designed.

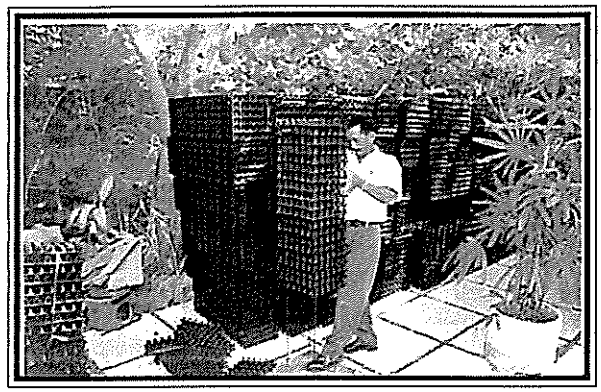
The use of fixed nozzle distributors together with shallow Biofilter installations also allows for lower hydraulic loading rates. This situation is common for secondary filters treating domestic sewage due to the low BOD-concentrations of those wastes.



BIOSYSTEMS **PACMEDIA™** Biological Wastewater Treatment Media

Sub Assembly of PACMEDIA Nylon Tying & Heat Welding

Sub assembly of **PACMEDIA** can use a combination of Heat Welding and Nylon Ties. You can use any combination depending on specific application.
When you intend to cut the media to fit into odd shapes such as in round Tanks or trimming round obsticles, we recommend you weld the end blocks for trimming purpose.



The media blocks slide off the frame for stacking.

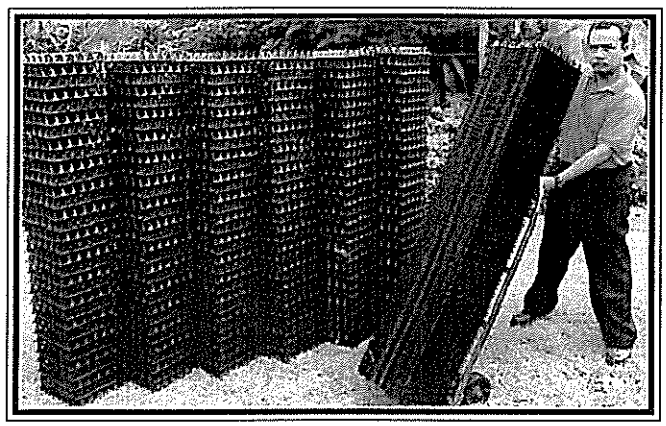
1. Equipment for Nylon Ties

1.1 Sufficient nylon tie in roles
1.2 Cutting knife and scissors
1.3 Steel jig with rods to correct height
1.4 Table for checking media blocks for lug alignment
1.5 Woolen gloves (optional)

2. Working Procedures for 1 metre Blocks

2.1 Stack media bundles close to steel jig
2.2 Cut sufficient Nylon tie in lengths of 2.8 metres.
You will require 18 lengths x 2.8 metres per cubic metre
2.3 Prepare steel jig by threading Nylon tie through the needle eyes at the top
2.4 Clear the media holes of any residual plastic where the Nylon tie is passing
2.5 Person 1 and 2 make up 1/2 metre blocks and tie outside ready for sliding down steel jig
2.6 Person 1 and 2 slide the 1/2 metre blocks down the steel rods and Nylon tie
2.7 Person 1 and 2 tie off using non slip knot and double tied to finish
2.8 Person 2 slides off the 1 metre blocks and lays on table for trimming and checking the locating lugs are all in place
2.9 Procedure is repeated and is perfected in a short period of time

PACMEDIA is shipped in bundles for easy handling



One (1) shipping bundle makes 6 media modules

3. Heat Welding Procedures 1 or 2 person

Certain applications may require welded blocks for cutting purpose i.e. circular or angles packing of media.

4. Equipment for Welding

4.1 1 Standard type heat gun

4.2 1 steel rod 12 ml diametre x 150 ml long

4.3 1 small table for sub assembly

4.4 Gloves may be required (optional)

5. Working Procedure

5.1 Person 1 takes 1 sheet at a time and places in position with the lugs pointing up

5.2 The heat gun is applied to the lugs for 2 to 4 seconds

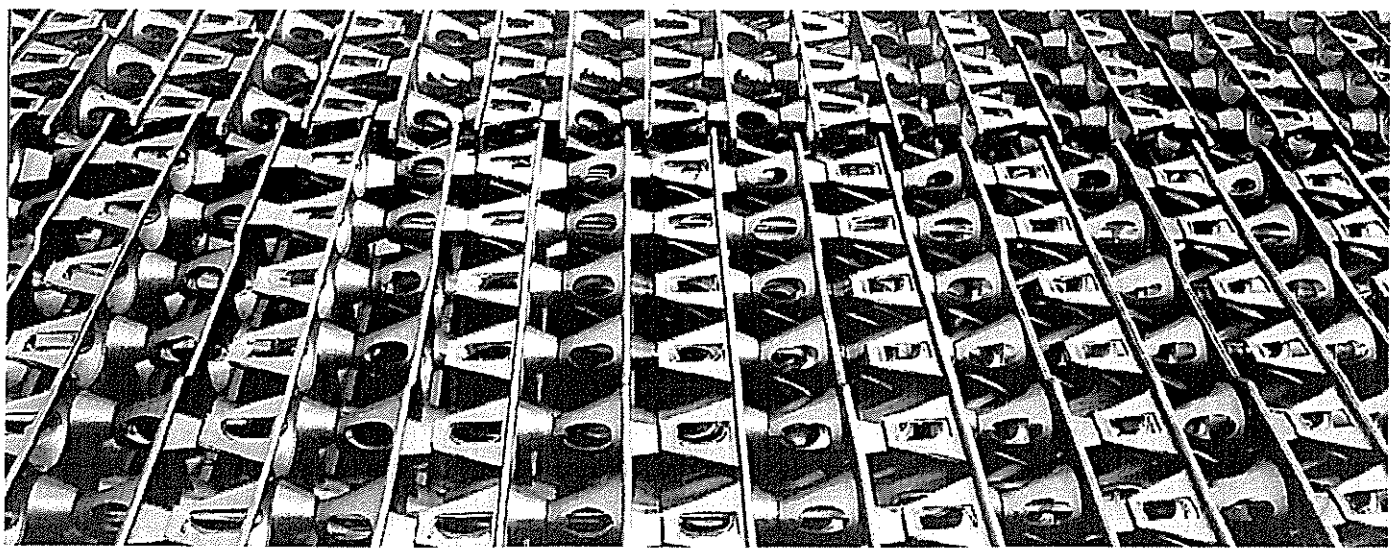
5.3 Person 1 pushes the steel rod down on the plastic lug and flattens the lug onto the next media sheet

5.4 This process is continued in all 6 lugs and repeated with the next sheet

5.5 You need to mark the blocks with paint to distinguish between the tied blocks and welded blocks for trimming or cutting purpose

Quality Control

When placing the media into a STP plant it is very important that the media blocks are placed tight against the walls. The Nylon ties are extremely strong but actually the locating lugs become the main horizontal strength when packed tight.



MAINTENANCE OF EQUIPMENT

The importance of proper care and maintenance of electrical and mechanical equipment at a treatment plant cannot be overemphasised.

Equipment such as pumps, motors, tools etc., are expensive to replace and some machine parts are difficult to obtain.

Therefore the operator and qualified+s maintenance personnel must strive to obtain the maximum service life out of every piece of equipment. This can be achieved by thoughtful plant operation and careful maintenance of equipment.

TYPES OF MAINTENANCE

Maintenance in general falls into two categories :

- Routine and Preventative Maintenance
- Breakdown Maintenance

ROUTINE AND PREVENTATIVE MAINTENANCE

This includes the work necessary for the general upkeep of the works and the equipment. This "house keeping" type maintenance never ceases and if attended to daily presents no problems. Schedules of maintenance consists of all the work that needs to done daily, weekly of monthly eg. painting of structures and equipment, repacking of valves, pump overhauls etc. This type of maintenance will keep breakdown maintenance to a minimum.

BREAKDOWN MAINTENANCE

This is required when a piece of equipment breaks down. This requires immediate attention so that the equipment can be put back into service, and usually disrupts both the operation of the work and the daily work of the operator. Breakdowns are often a result of inadequate preventative maintenance.

MAINTENANCE PROGRAM

To keep equipment and work structures at optimum performance, a maintenance program will be prepared and carried out. This consists of a record system for each item of work equipment and the use of charts showing the equipment and maintenance requirements that are to be done daily, weekly, monthly, etc. Scheduling of maintenance avoids missing or overlooking necessary maintenance and also helps avoid confusion if there is change of staff at a treatment plant.

In order to prepare an effective maintenance program it is essential to have the following :

a. A complete set of +works as executed+ drawings of the civil structures and layout drawings of the civil structures and layout drawings of all plant, equipment and pipework. (Supplied on commissioning phase)
b. Maintenance instructions for all mechanical equipment complete with spare parts lists
c. Circuit diagrams for all electrical installations.

An equipment record system will be set up. Every building, structure and item of equipment will be given a number. A card, identified by the appropriate number will be prepared for each piece of equipment and filed in numerical order.

The information on each card will include :

(a) Name and location of the equipment;
(b) Name and address of manufacturer, builder or supplier;
(c) Installation date;
(d) Type, style and model No.;
(e) Capacity, size, etc;
(f) Serial and code Numbers;
(g) Nature and frequency of maintenance;
(h) Proper lubricants and coatings.

The back of the cards is used as a service record and will include the dates on which work was performed, the type of work undertaken and the name of the person who did the work. Any breakdown maintenance done will also be recorded.

The maintenance program once established will be followed up by regular inspections of the work performed, the type pf work undertaken and the name of the person who did the work, Any breakdown maintenance done will also be recorded.

GENERAL MAINTENANCE

Mechanical maintenance is important as equipment must be kept in good operating condition. Instructions from the Manufacturer should be followed closely whenever doing mechanical maintenance on equipment.

Inspection and maintenance of electrical equipment must only be done by qualified Electricians.

Electric motors should be checked for bearing temperatures and vibration. Most motors have the safe "temperatures rise" marked on their nameplates. The operating temperatures is a good guide to whether or not the motor is operating correctly.

Excessively high motors temperatures should be checked. Lubrication of a motor varies with the type of motor, with some motors being "permanently greased". It is recommended that motor lubrication be left to a qualified person as over-lubrication can cause damage.

In general, care of equipment should include :

a. Frequent inspection and proper lubrication.
b. Clean, wipe, paint or otherwise protect equipment from grease, grit and corrosion.
c. Keep all frames, supports, housing and other immovable parts well painted.
d. Periodically check for leaks, squeaks and wear in machinery and test for efficiency.
e. Avoid dampness and excessive moisture around electrical equipment and switchgear.
f. Periodically test all safety devices and electrical machinery.

GATE VALVES

Hand operated valves require lubrication of the screw and hand wheel bearing to ensure smooth operation.

The gland packing should sufficiently tight to prevent leaks.

When the shoulders of the gland are hard up against the valve body, additional packing rings should be inserted. When replacing packing with the new material, a woven square grease hemp packing is used for water lines, and a graphite impregnated asbestos for air lines.

For special valve and valves on gas lines, maintenance should be carried out strictly in accordance with the manufacturer's instructions.

TOOLS

Tools should be stored in a suitable storage shed, with special precautions taken in the storing of paints, solvents and chemicals.

Tools available at the works should includes brooms, squeegees, scum hoes, skimmer, slot cleaner (Imhoff tanks), sludge sounders, hoses, suction buckets, bottle brushes, lawn mowers. wheel barrow, square mouth shovel, pick, hoe, rake and selection of hand tools. Special tool will also be supplied by the equipment supplier.

BUILDINGS

Building at a works are usually constructed of sturdy material and have an operating life of many years. Regular maintenance is necessary to keep them in good repair.

Metal surfaces such as roofs, gutters, window and door frames and metal work such as motor and pump housing , railings and gratings all require regular painting. Before painting, the surface should be thoroughly cleaned and any loose paint removed. Without proper preparation, painting will not be effective, the paint will not adhere correctly to the surface.

Painting serves a twofold purpose of preventing deterioration of the structure and providing a pleasing appearance.

8.1 DUTIES OF AN OPERATOR

This section covers the routine duties that an Operator may be required to do in addition an actually operating and maintaining the works. They are equally as important and can assists the operator in operating the works at optimum efficiency.

A. Plant Records

The keeping of systematic, accurate and regular operating and maintenance records is an important part of treatment works management. Well kept records are important because:

a. They are indicators of satisfactory operation.
b. They form a permanent record of plant performance which may be of use in legal presentations.
c. They are the basis of making reports, costs, costs of operating and recommendations for improvements or modifications to the plant.
d. They serve as a basis for further expansion or augmentation.
e. They serve as a guide to future operations by showing up repetitive problems in plant processes
f. They are required by the regulating government authorities.

If the plant records are to be of use, they should be kept on a regular basis and be accurate. As they need to be retained for several years, they should be entered in a suitable notebook. Legibility and neatness is also important so that they can be read and used by others.

B. Types of records

The detailed information included in records will vary with the size, type and complexity of the plant.

Generally for each plant the following should be covered.

C. Operations Log

From the previous sections it can be seem that there are a number of physical observations and test procedures with the operator should undertake.

By maintaining a record of these observations and test results an operator can by referring back, recognise imminent operating problems and take remedial action. These operation logs consist of two parts: Daily Records and Monthly or Weekly Reports.

D. Daily Records

These consist of a diary, or plant log which will contain a wide variety of information such as :

- Time spent on the plant-failure of equipment-requests for maintenance, stores, etc.

- Observations of status of plant
- Floods or other unusual events
- Accidents
- Complaints
- Visitors and their purpose at the works

E. Monthly or Weekly Operation Reports

These should contain a summary of all data collected. By using monthly average figure any trend in operating conditions and parameters can be seen.

These reports should be submitted to the Operator's supervisor for any action he may require.

F. Maintenance Records

Maintenance record are part of the maintenance program discussed in Section 16.2

The record written on the back of the equipment service card, should include details of repairs made, parts used or purchased, overhauls and routine servicing accordance to manufacture+s instructions. This should be done for each item of equipment, as well as all buildings and structures.

The Daily, weekly and monthly checklist chart must be correctly filled out.

G. Laboratory Testing

Good control of operation procedures is obtained by knowing the principles involved, and the technique required for performing and interpreting some tests.

Certain tests are carried out to ensure that the effluent leaving the plant meets the conditions of the local statutory authorities.

Testing falls into two categories :

1. On-site tests : these are simple tests carried out on all works to indicate whether the works is performing satisfactory.
2. Laboratory test : these are more complex tests carried out in either a central laboratory or on site at a large plant. On small plants the operator provides assistance by carrying out these tests, interpreting the results and advising on any adjustments to the process that may be necessary.

H. Sampling

Sampling is the first and extremely important step in any testing procedures. It is essential that the sample is a true representative of the whole to reduce the risk of training misleading results.

The following steps will assist in obtaining representative samples.

Sampling should :

a. take place where the liquid or material is well mixed
b. not include large particles
c. not include deposits, growths or floating materials
d. be examined as soon as possible
e. be taken from the same place every time
f. be as safe and as easy as possible to obtain

The sample collected should be placed in a container that has been wetted with a portion of the same taken. This portion used for wetting should be discarded.

There are two types of samples :

1. Grab Sample,which is one where all the sample is collected at the same time. It will only give information about the sample at the instant of collection. Grab samples should be collected from the same place and at the same time of the day.
2. Composite Sample, which is one made up of parts of sample collected over a period of time. For example it might be a composite of certain amount every hour for 24 hours or a certain amount every five minutes for half an hour. A composite sample gives a reasonable average of the waste water during the sampling period.

Basic sampling equipment includes a sampling dipper or a bucket, sample bottles and graduated cylinders, and possibly a refrigerator as well.

GUIDELINES FOR SAFETY IN WASTE WATER WORKS

GENERAL

The designer has responsibility to ensure that safe structures are built. The owner, has responsibility to ensure that the works are properly maintained and operated, and to ensure that the operators are instructed in safe working practises and procedures.

An operator in charge of a works has responsibility of ensuring that assistants have received adequate instructions in safe working procedures.

Assistant operators have the responsibility of carrying out these safe working procedures to protect the health and safety, not only of themselves but also their colleagues. The old adage of "familiarity breeding contempt" must never be allowed to develop. As operators who disregard safe working practices with the attitude "it could never happen to me" are a danger to workmates as well as themselves.

The following sections outline some of the hazards likely to be encountered around waste water works. The information and advice contained is not all encompassing and operators should make themselves aware of potential hazards as their own works.

PREVENTION OF ILLNESS AND INJURIES

The prevention of illness and injuries requires continuous attention to all the elements in and around waste water works.

This starts with regular inspection and maintenance of any feature and equipment designed to prevent physical injury to operators and from illness that may be caused by bacteria, chemicals or noxious gases.

Accidents do not just happen, they are caused and therefore are preventable.
The basis of accident and injury prevention is the application of a few basic rules and a knowledge of the hazards involved.
This knowledge includes, what to do, how to organise and avoid creating hazardous situations - how to identify noxious gases, and to report hazardous situations

HOUSEKEEPING

Good housekeeping includes:

a) The proper maintenance of the works and the site:
b) The proper handling and storage of equipment and materials
c) Prevention of hazards inherent with accesses through floors, hatchways and areas around open tanks.

LIGHTING

Inadequate lighting creates a potential hazard. If inadequate fixed lighting is installed, portable lighting should be provided.

PERSONAL HYGIENE

It must be realised that sewage contains or is liable to contain pathogenic (harmful) organism, (eg. viruses and harmful bacteria) and there is always a certain background of risk. these organism can cause such illness as Chlorella, Typhoid and Paratyphoid Fever, Dysentery, Hepatitis, Tetanus, and other infections.
With respect to the H.I.V. (AIDS) virus, current information suggests that the virus is unlikely to survive in a harsh environment, such as sewage for along time. However, care should be taken to eliminate risks of needle stick injuries.
The position of the operator is similar to that of a doctor or nurse, in that both are exposed to the risk of infection, and that in both cases, provided precautions are taken, no ill- effects should result.

The most common ways for an operator to pick up an infection is through the nose and mouth or through cuts and abrasions to the skin.

Four basic rules for personal hygiene are:

(a) Keep soiled hands below the neckline

(b) Wash hands with antiseptic soap, solution or cream using cool water as soon as possible after completing a dirty job and definitely before eating or smoking.

(c) Attend to all injuries, however small, promptly.

(d) Work clothes should only be worn whilst on duty. Laundering should be done separately, preferably on site, to avoid carrying infections into the house or community areas.

Cleanliness in and around amenities buildings is essential, especially in regards to cutlery, crockery, hand basins and showers.

MEDICAL SERVICES AND FIRST AID

The names, addresses and telephone numbers of doctors, hospitals, ambulance and other rescue services should be conspicuously displayed in the amenities building preferably next to the telephones.

It is desirable that all operators be trained in First Aid, including CPR.

A first aid kit should be readily available, properly maintained and stocked, for immediate use.

ELECTRICAL AND MECHANICAL EQUIPMENT

Most waste water treatment works incorporate electrical and mechanical equipment. Properly trained/ qualified personnel are to only ones who should be permitted to operate/switch such equipment.

Particularly dangerous is the switching on of equipment, without warning men working on or about it. Remember the rule of **"only the man who places danger tags on equipment, may remove the tag."** Operators should visually check all electrical cables for damage before use.

Electrical powered tools should either be doubly insulated or be connected to a properly either outlet.

All equipment should be regularly tested by an appropriate and qualified person.

PUMPING STATIONS

Pumping stations have inherent hazards that arise primarily from the moving equipment and from housekeeping, in addition to those normally to be encountered in a confined space.

There are two major types of pumping station, those with both wet and dry wells and stations with submersible pumps that have a wet well only.

Wet and Dry Well Type

This type of station allows an operator to have easy access to the pumping equipment and this creates a hazard because of the proximity of rotating machinery.

All shafts, connections, etc. should be guarded to prevent accidental contact.

Good housekeeping is essential. Debris, mud, oil and grease, etc. should be cleaned up and tools and materials properly stored to avoid slipping and tripping.

Dry wells are normally subject to high humidity and leakage around pumps seals and should be provided with sump pumps which must be properly maintained.

The dry wells should also be provided with positive ventilation to minimise the humidity and to assist in the removal of gases.

The precautions for entering a confined space must be followed. If a permanent ventilation system is not installed, it may be necessary to use a portable blower to provide a supply of fresh air. It is essential that adequate lighting be provided and the operator should ensure that all lights are kept clean to provide maximum illumination.

The risk of oxygen depletion or the presence of toxic gases or vapours is greater in a wet well than a dry well. The installation of a completely separate ventilation system is essential. The operator should ensure that all openings between the wells are completely sealed.

An additional hazard is caused by the possibility of an increase in water level due to incoming flow. Before undertaking work in the wet well the operator should shut off the valves on the incoming sewer, as part of the isolation required by the Permit to Enter or install emergency stand-by pumping equipment.

An operator should not enter a pumping station without support staff on the surface, and should wear a safety harness attached to a suitable recovery system.

Safety helmets must be worn when working below ground level especially when support staff are moving about above. To further guard against head injury all tools and equipment used in the area should be lowered and raised by a basket and rope other suitable container.

The operator should isolate all mechanical equipment before working in a wet well or before attempting to carry out any maintenance work.

If the station is has screening baskets, they should be removed and cleaned on an adjacent hard standing. At no time should an operator reach into the basket from the surface to remove screenings.

Submersible Pumping Stations

The same safety measures as pertain to a wet well apply to submersible pumping stations

An operator should not attempt to undertake maintenance work on a pump whilst it is still in the well. The pump should be isolated and lifted clear of the well using proper hoisting equipment.