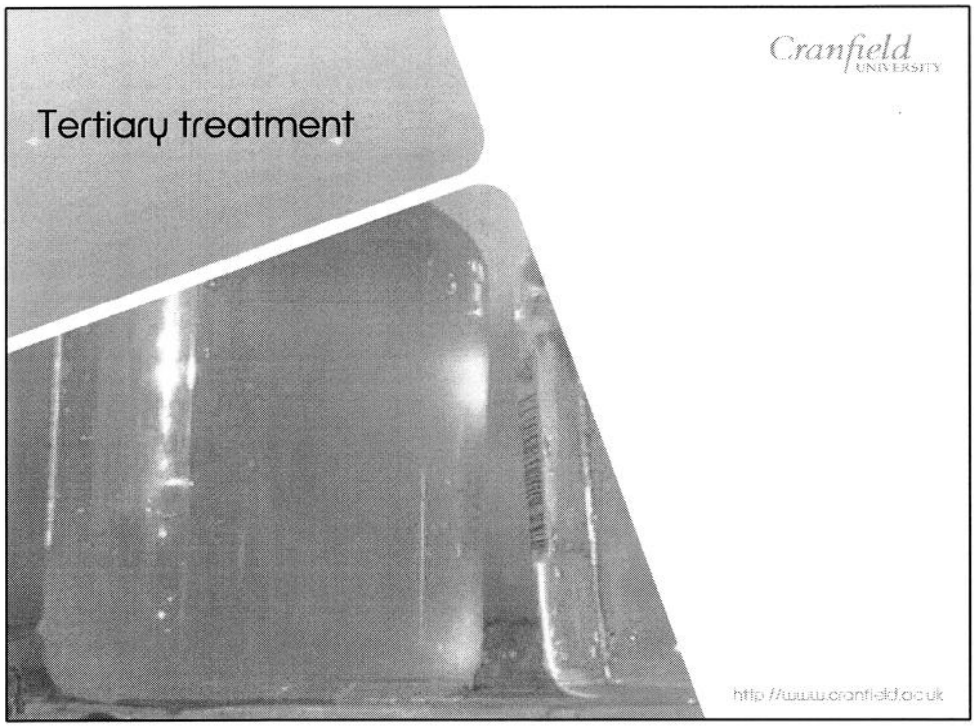
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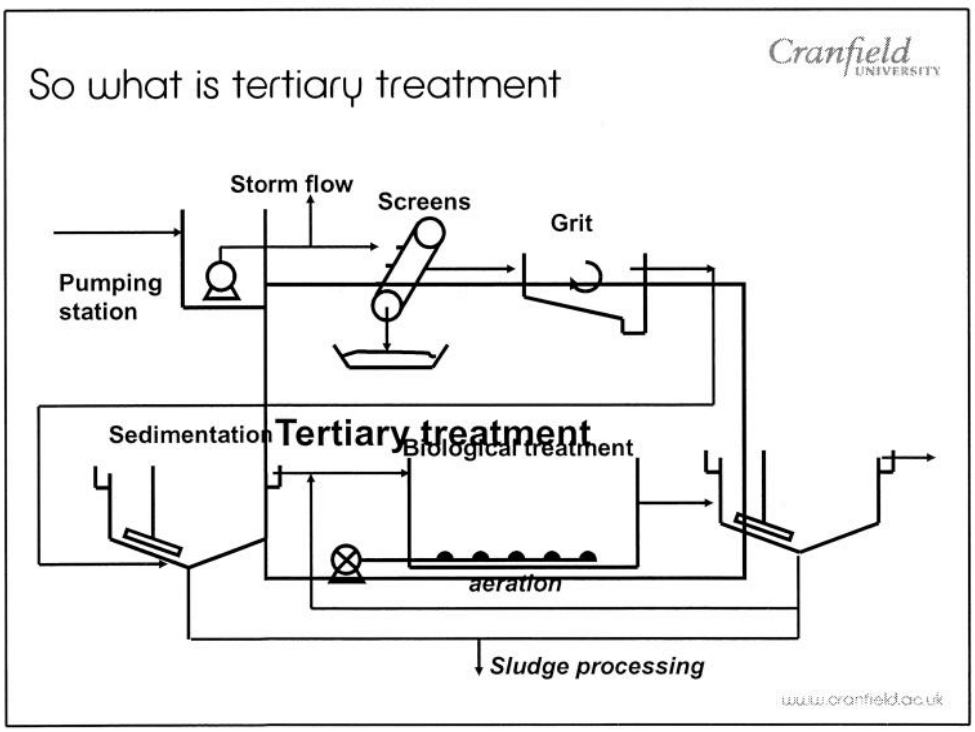
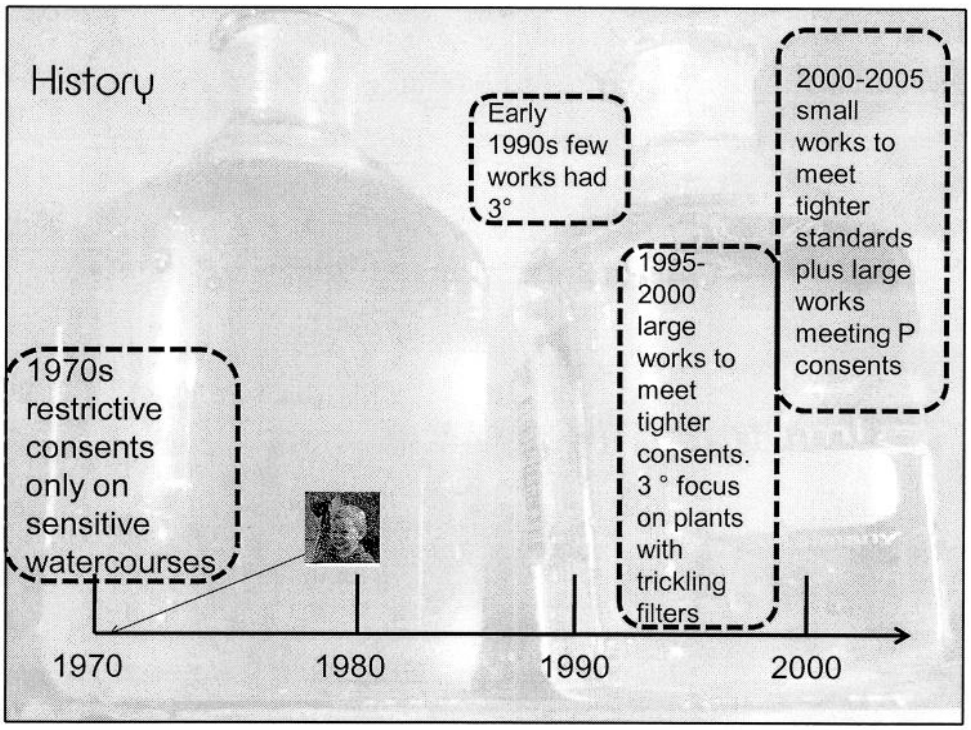
Tertiary treatment
http://www.cranfield.ac.uk

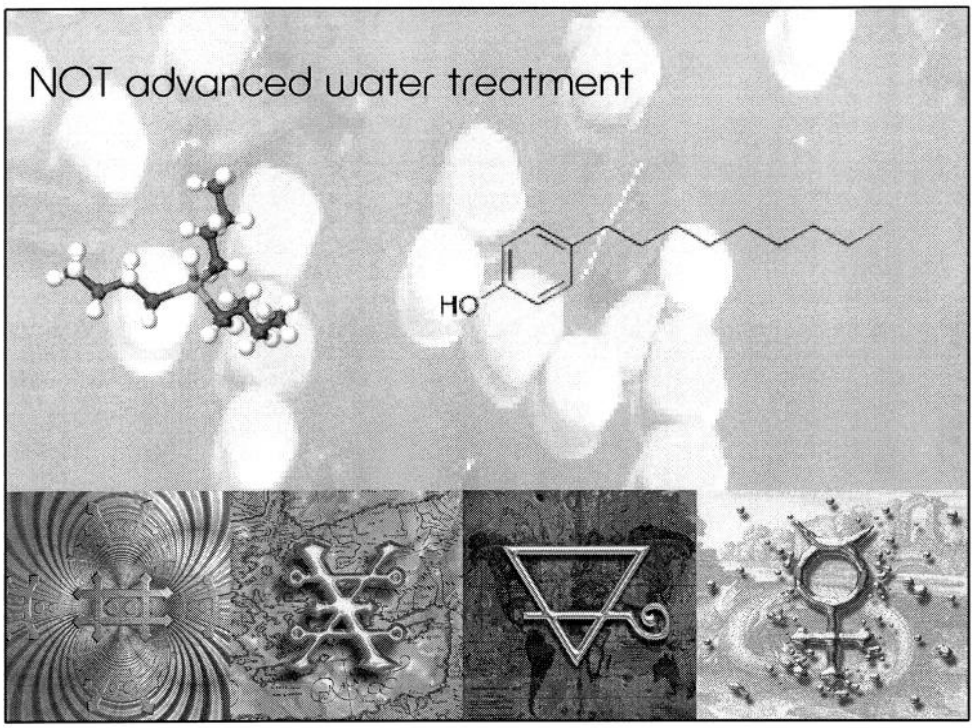

Cranfield
UNIVERSITY
So what is tertiary treatment
Storm flow
Screens
Grit
Pumping station
Sedimentation
Tertiary treatment
Biological treatment
aeration
Sludge processing
www.cranfield.ac.uk

1974 manual of British Practice

"the further treatment of biologically treated sewage by removing suspended matter to enable the effluent to comply with a standard more restrictive than 30:20 before discharge to a body of water"

History





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Typical concentrations

- Advance Water Treatment -

	3°		AWT
Parameter	Typical level	% removal	Typical level
BOD	<10	5	n/a
TSS	<2	5	n/a
TOC	<10	8	<1
turbidity	<1	15	<0.3
Ammonia	<5	2	<1
P	<0.5	5	<0.1

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Technology options

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Classification	Original	Modern version
Irrigation	Grass plots	Wetland
Settlement	Lagoons	Ballasted settlement
Straining	Microstrainers	Drum or Disc filters
Filtration	RGFs	Deep bed or continuous

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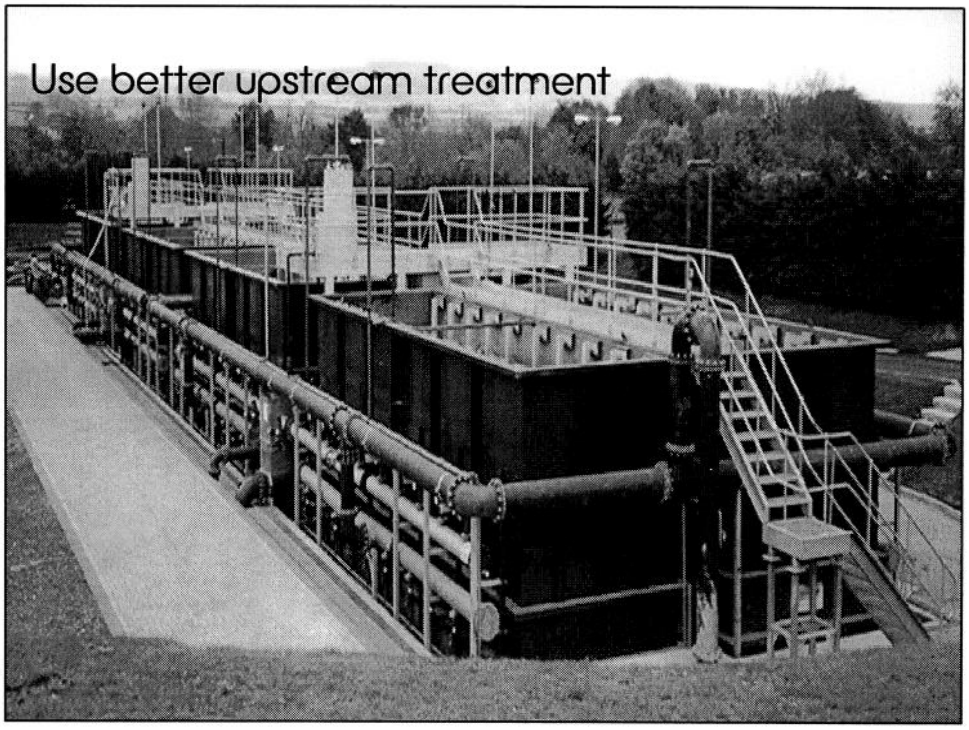
Use better upstream treatment



Constructed wetland

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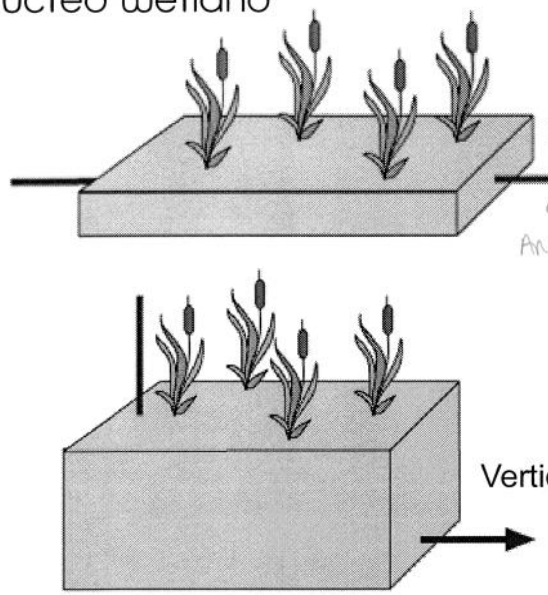

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Horizontal flow (99 Z)DK)

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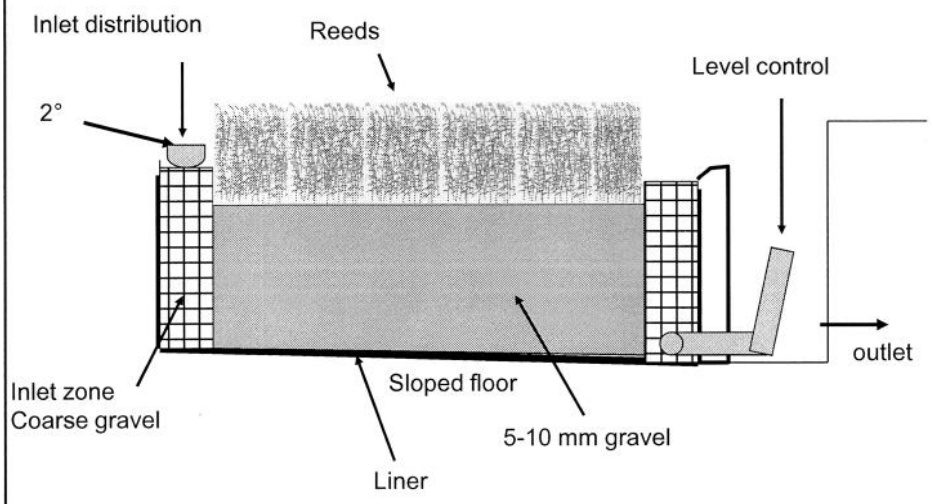

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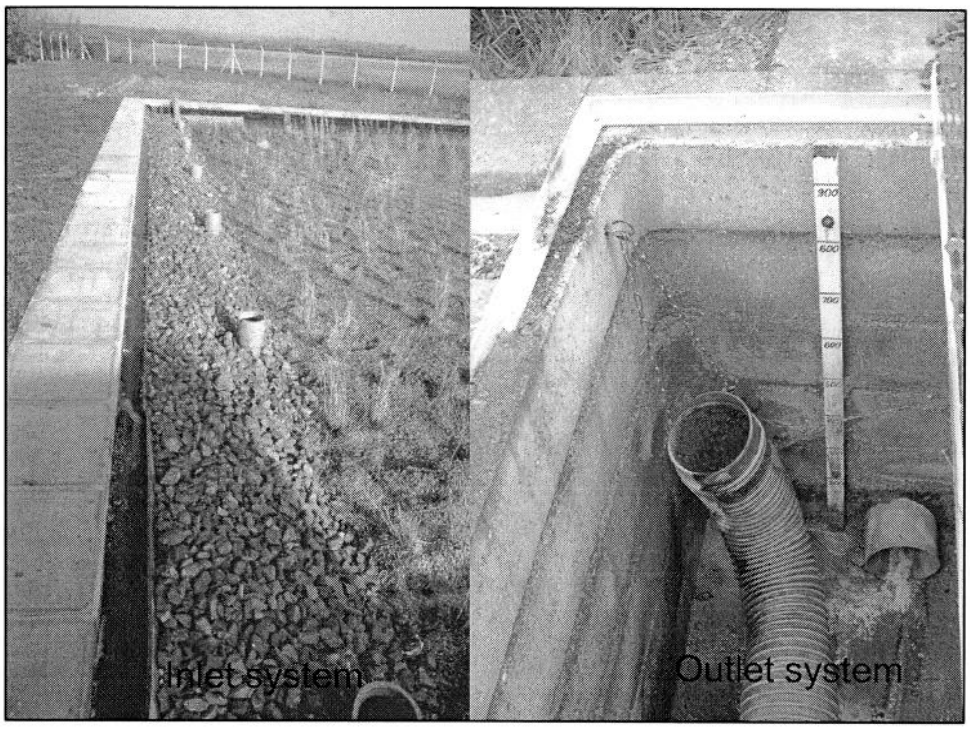
Inlet system
Outlet system

Package plants

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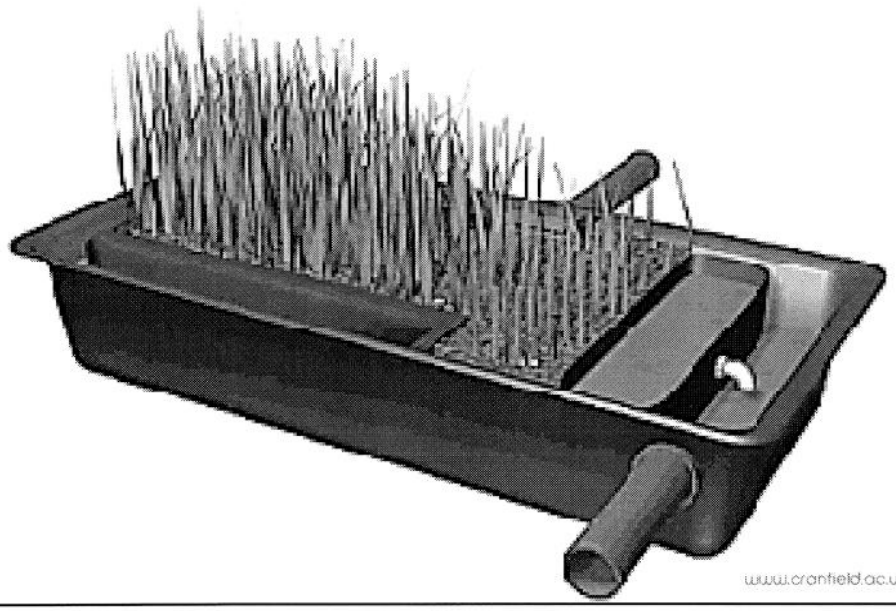

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Key facts

Submerged flow

Anoxic/anaerobic

Reeds for bed porosity (NOT treatment)

Very popular for small works in parts of UK (eps. Severn Trent)

- First installed in 1986
- Now more than 350
- Mainly post RBC but some post TF and AS
- Employed when better than 25/45 required

Vertical flow

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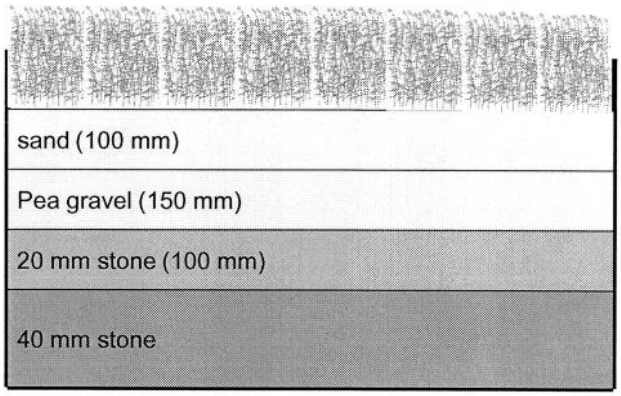

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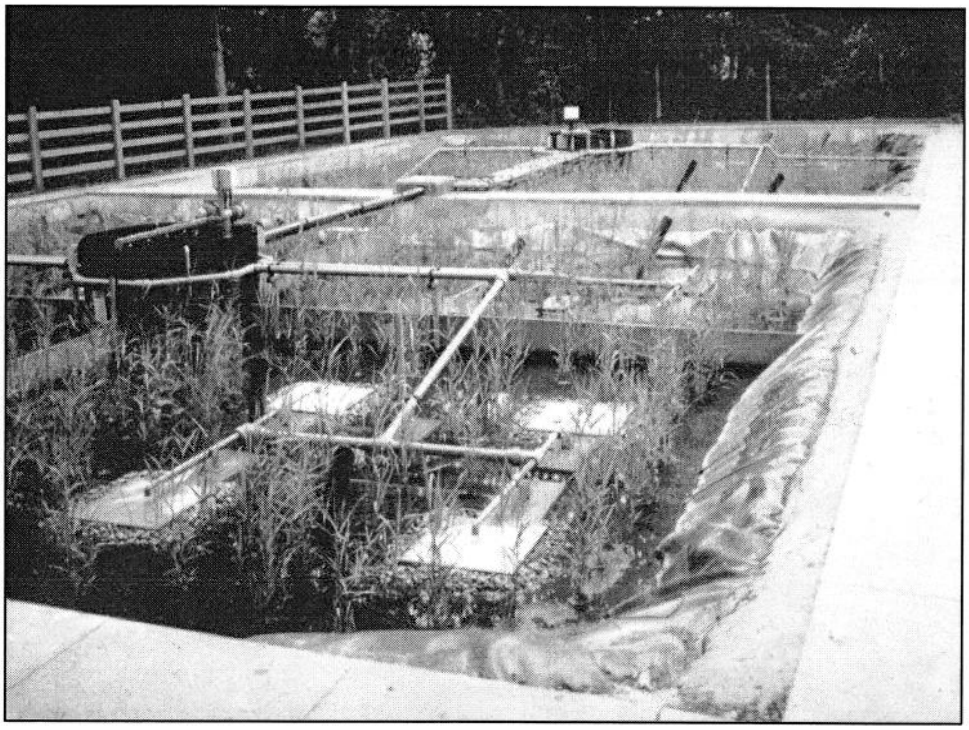

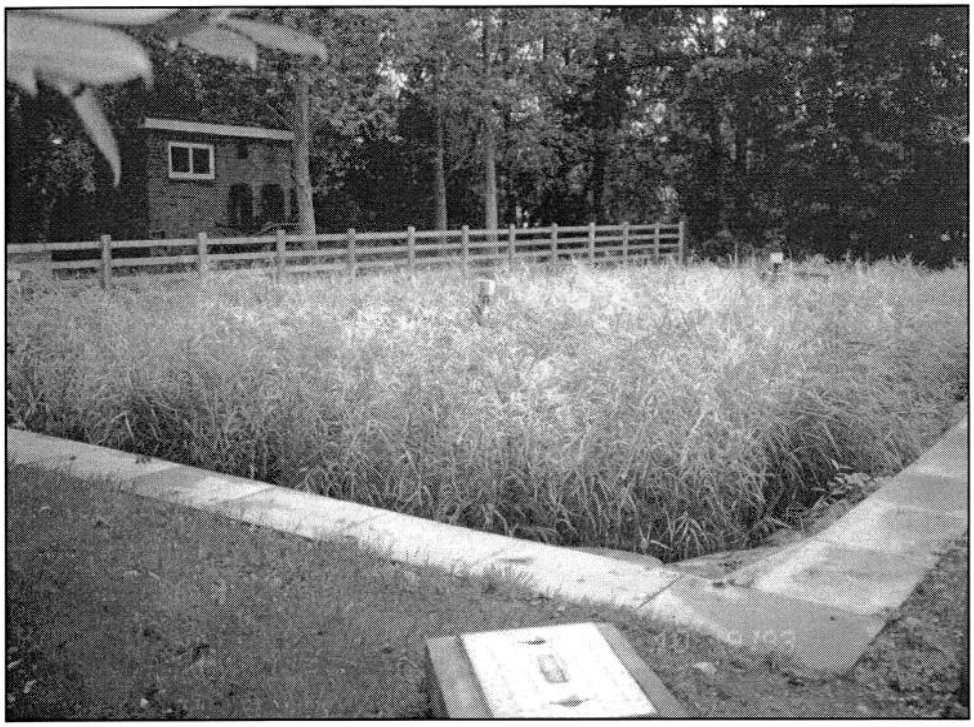

problems - solids build up

We use the reed to prevent problems with the plants roots (collect)
Other problem : rabbits

Constructed wetlands: Key facts

Designed at $0.7 m^2.p.e^{-1}$ (horizontal flow)

HRT = days (a lot of land is needed)

When 2°effluent is well oxidised then 3° will meet:

- 2-4 $mg.L^{-1}$ BOD
- 4-7 $mg.L^{-1}$ TSS

Enhanced settlement

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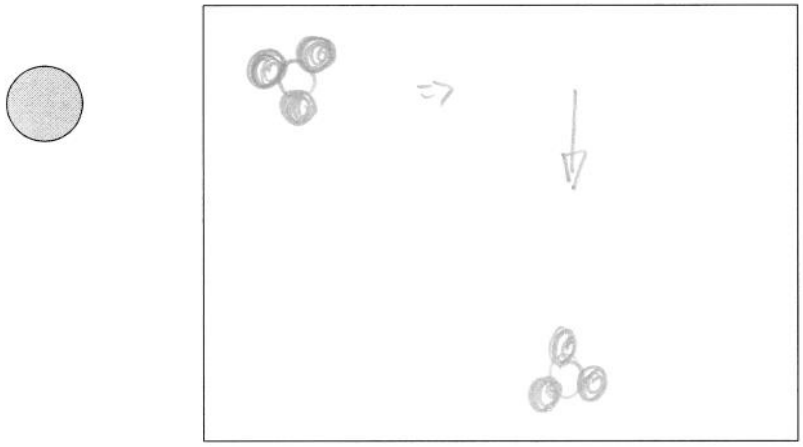

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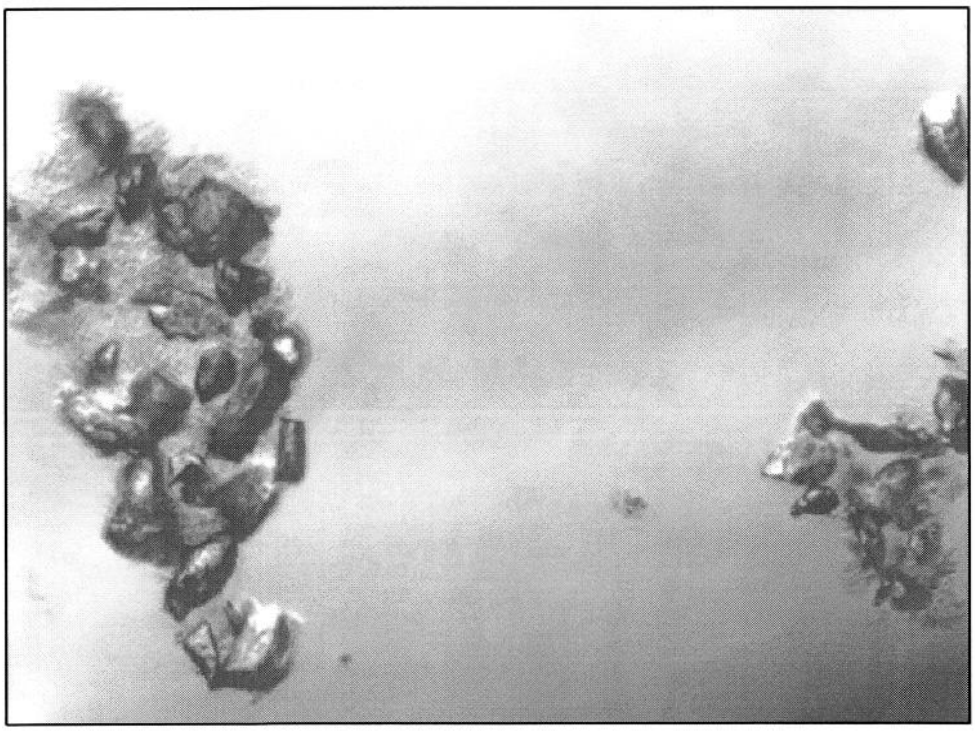

Enhanced settlement: Sand

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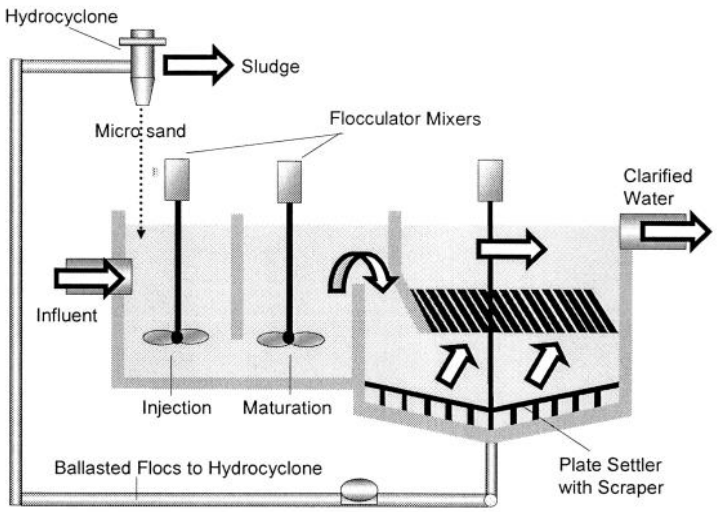

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Use sludge instead of sand

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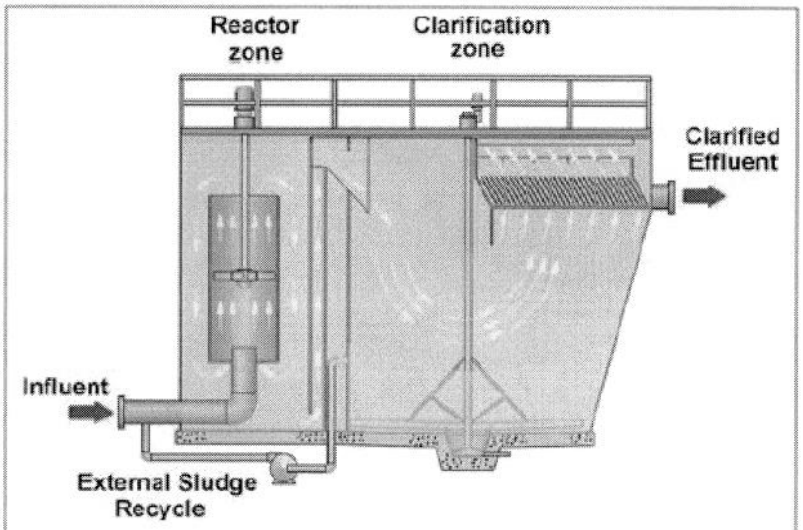
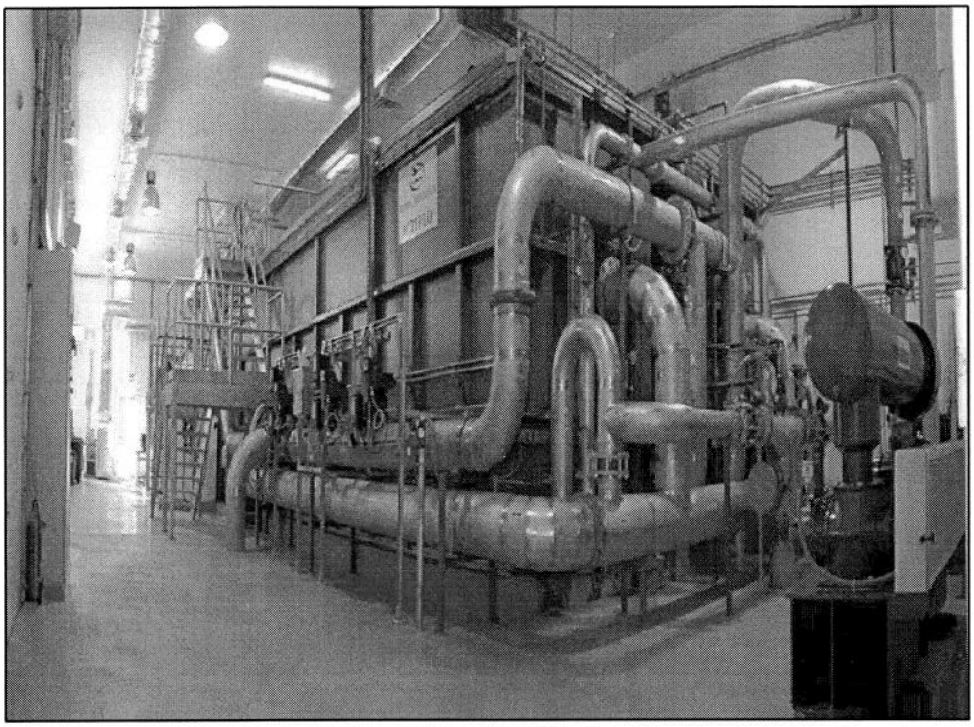


Figure 1 – Densadeg® Process Schematic

anfield.ac.uk



Comparison of size

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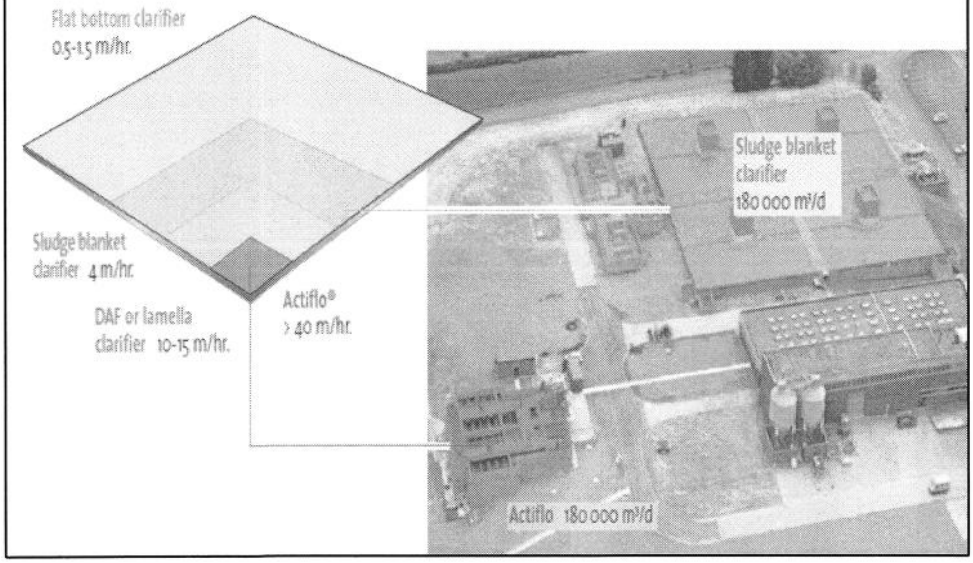

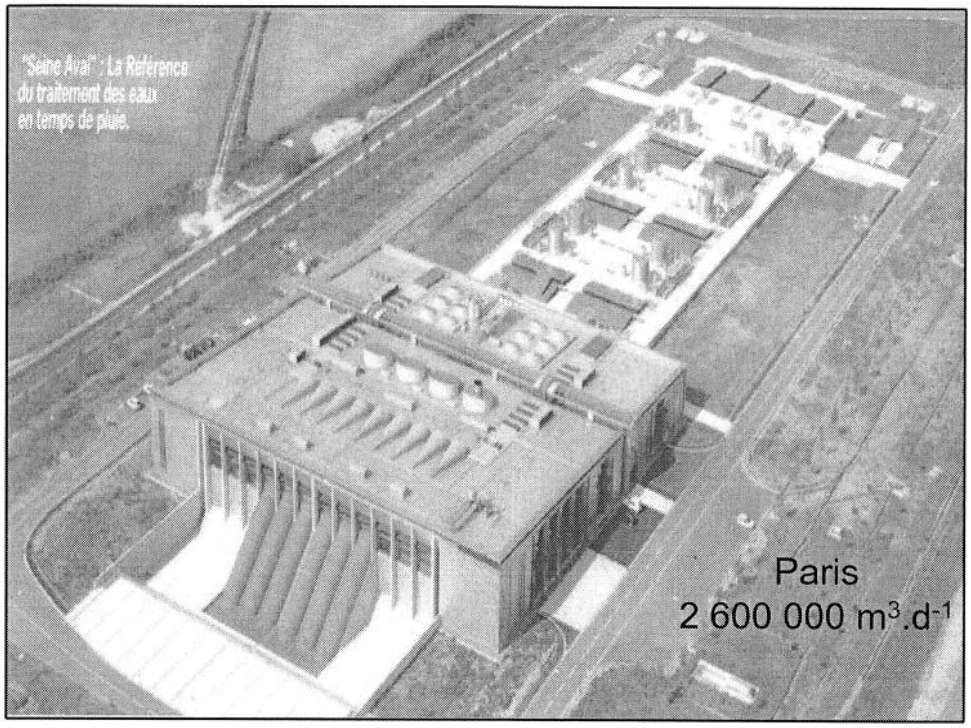

Enhanced settlement: Key facts

Overflow rate >40 $m.h^{-1}$

Removals:
TSS: 50-85%
COD: 20-50%
TP: 50-95%
Heavy metals: 80-95%
FC: 1-1.5 log (coliforms)

Rapid start up

Filtration

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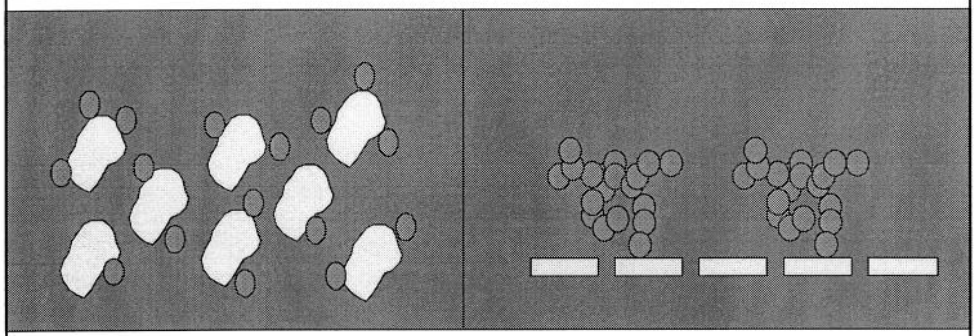

1- Deep bed filters

2- Surface filters

Big slower, ↑ quality effluent.

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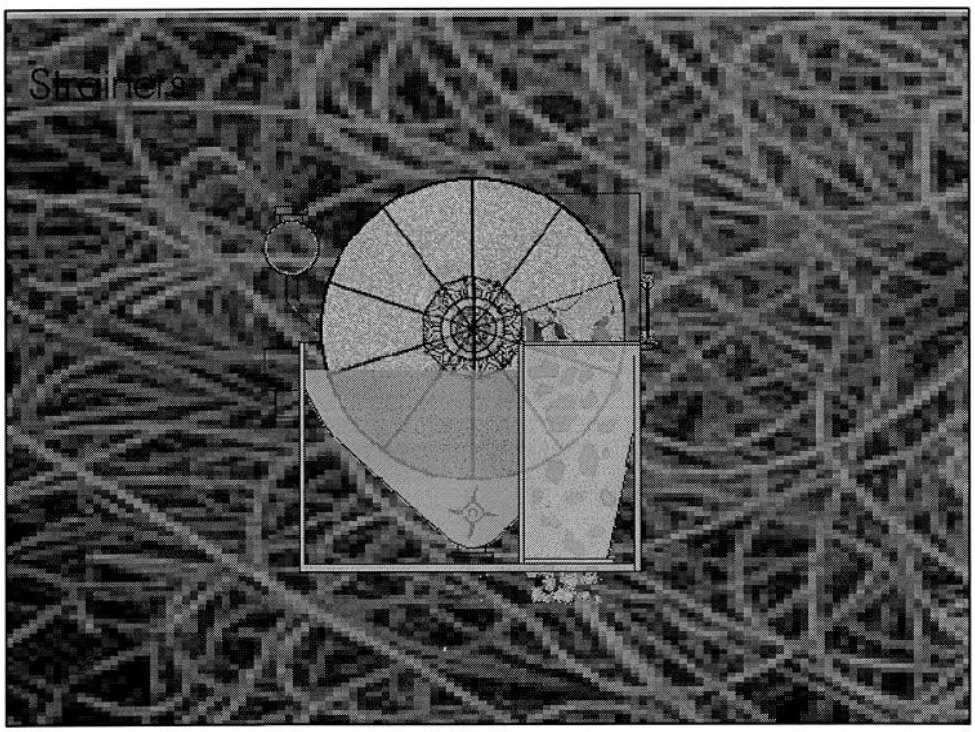
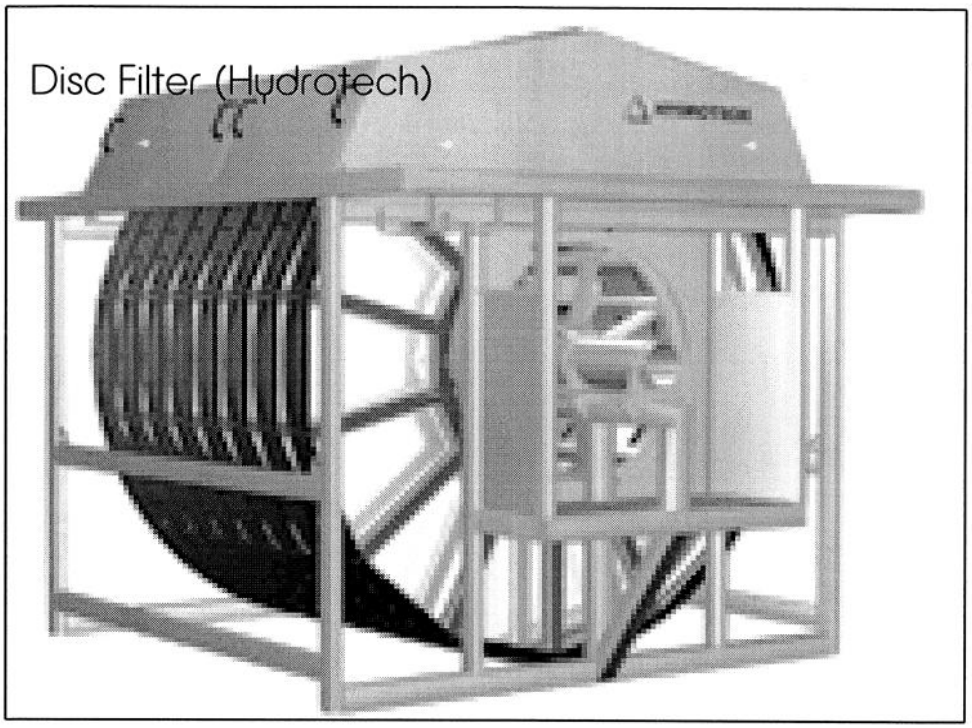
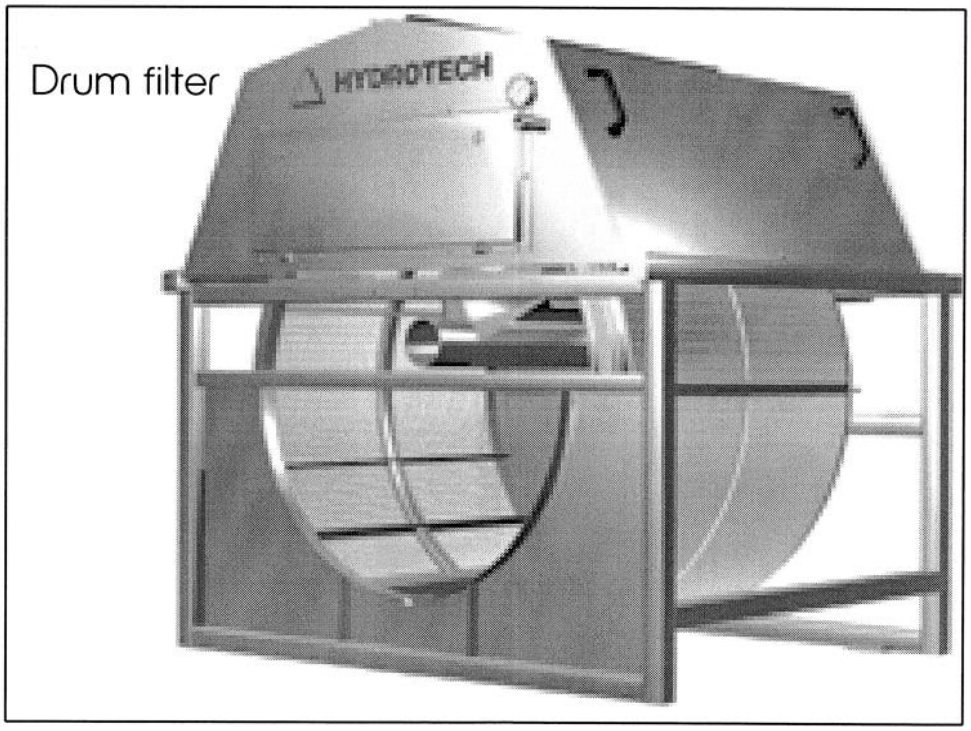
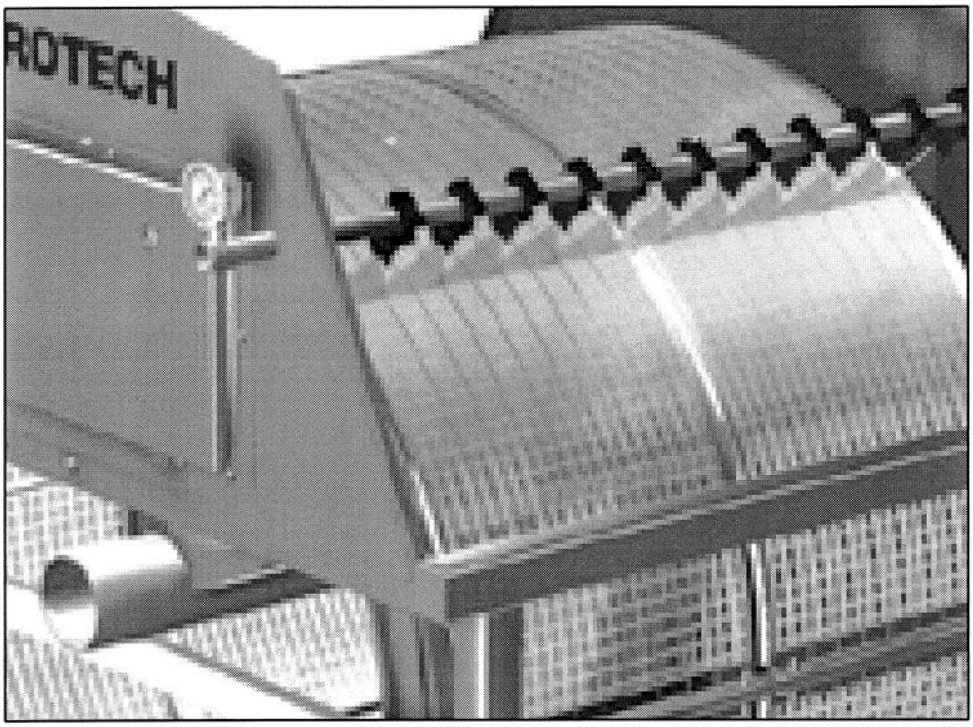


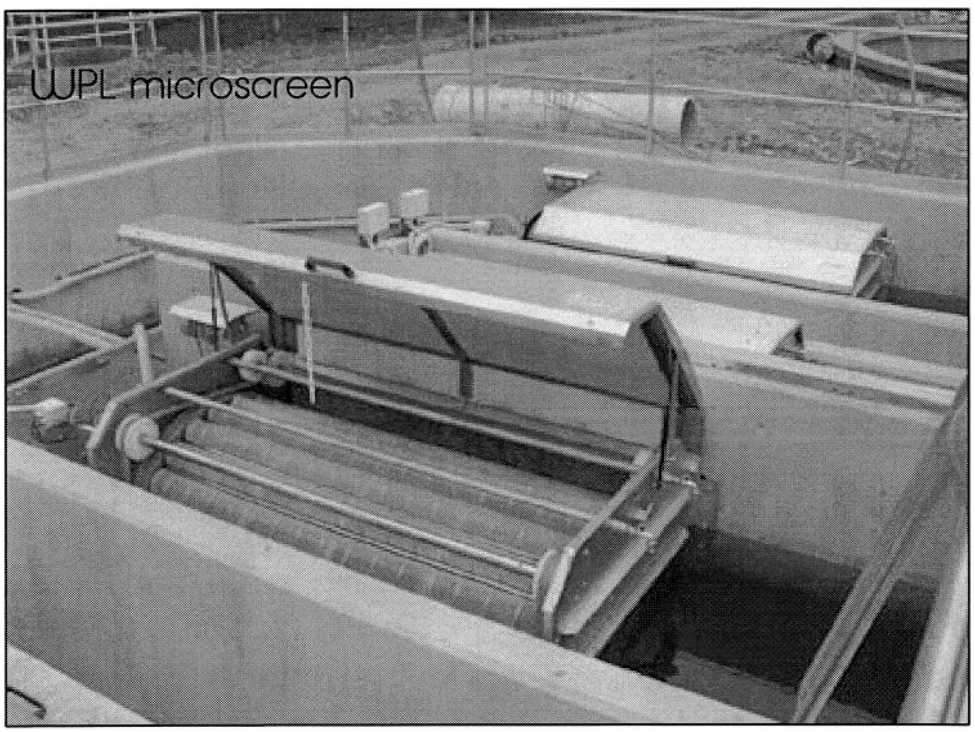
Disc Filter (Hydrotech)



Drum filter




ROTECH


WPL microscreen

Filters: Key facts

Process acts as true surface filter
Generally chemical free but limits performance
Regulars regular cleaning (weekly-monthly)

Removal:

- SS: 70-80%
- SS: 5-15 $mg.L^{-1}$ achievable
- BOD:30-40%
- BOD: <10 $mg.L^{-1}$

Deep bed filters

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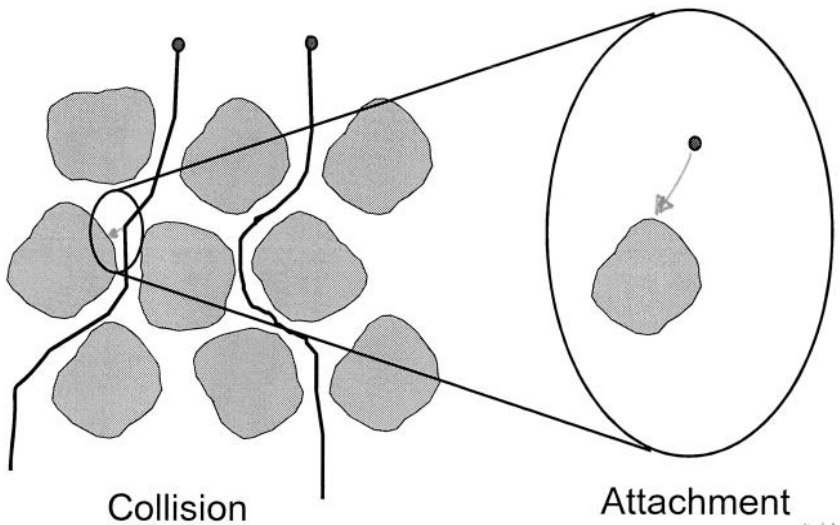

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Original potable water filters were used

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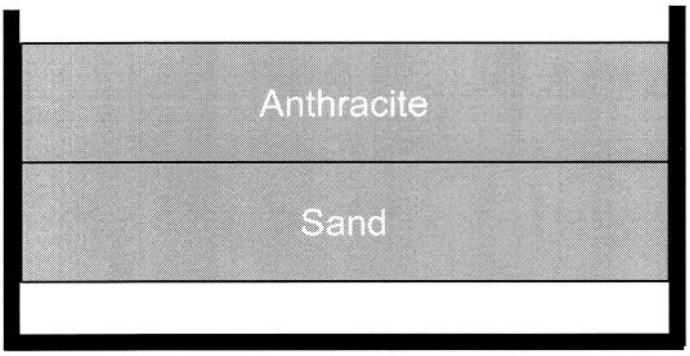
Inlet: 1-2 NTU

Inlet: 7-20+ NTU



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Two main types are now used to resolve the solid problems

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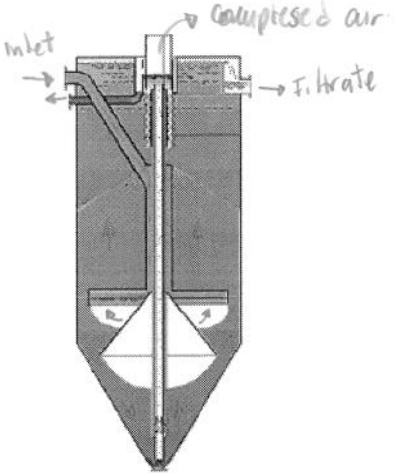
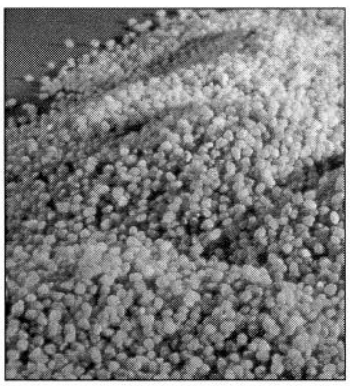


Continuous backwash



Very deep bed coarse mono media

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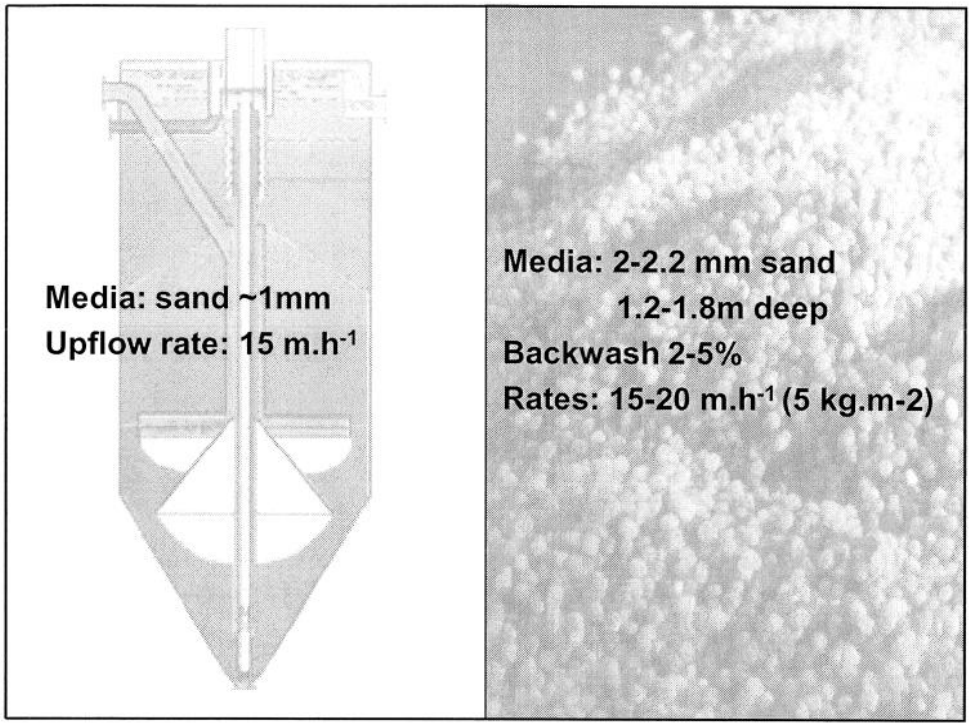
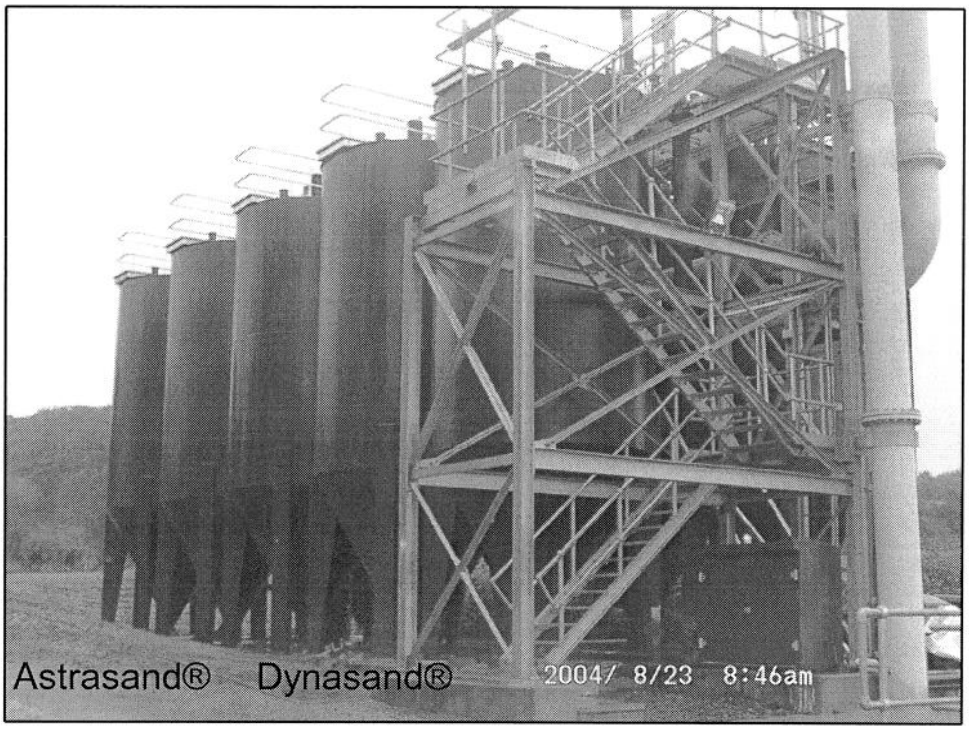
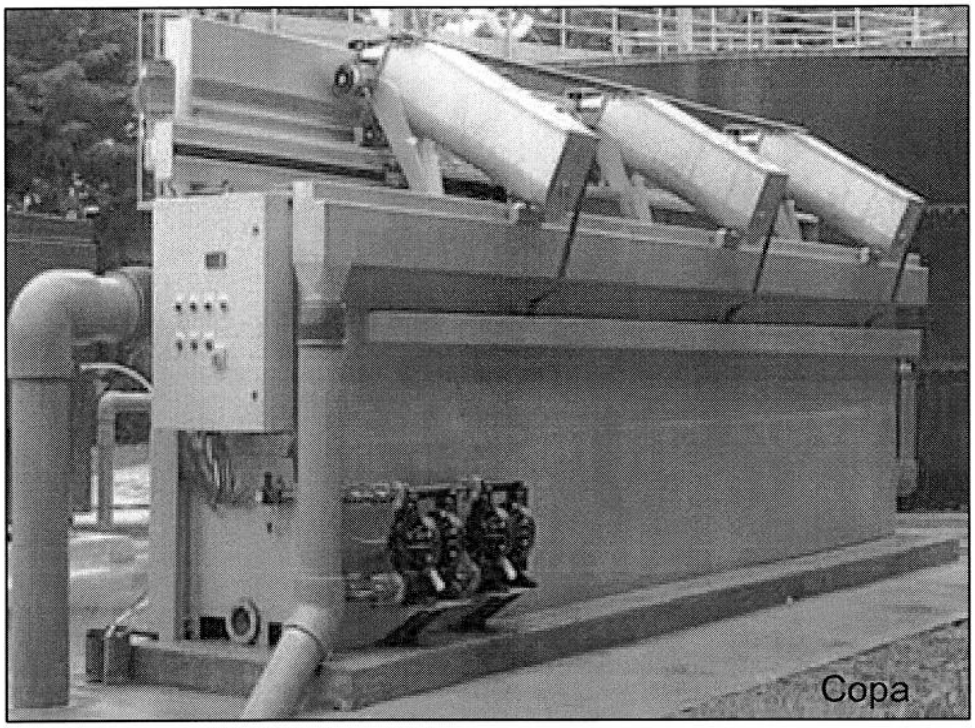
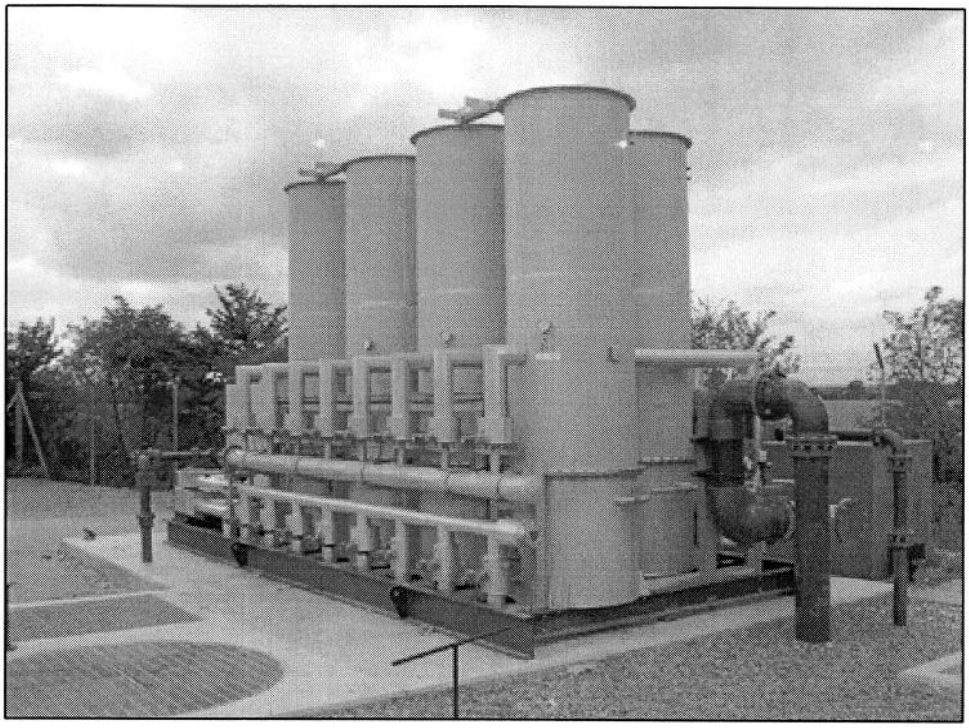

Media: sand ~1mm
Upflow rate: 15 m.h-1
Media: 2-2.2 mm sand
1.2-1.8m deep
Backwash 2-5%
Rates: 15-20 m.h-1 (5 kg.m-2)


Astrasand®
Dynasand®
2004/ 8/23 8:46am


Copa


2004/ 8/24 9:37am Tetra



Deep bed filters

Stable effluent quality 2 NTU (3.2 $mg.L^{-1}$)
when influent less than 7 NTU

Practice
- < 10 $mg.L^{-1}$ SS
- <10 $mg.L^{-1}$ BOD

Removal : 70-85%

Depth filters can be adjusted to remove nutrients

Not common in UK
To denitrify, adding carbon source.
Also remove P and NH3

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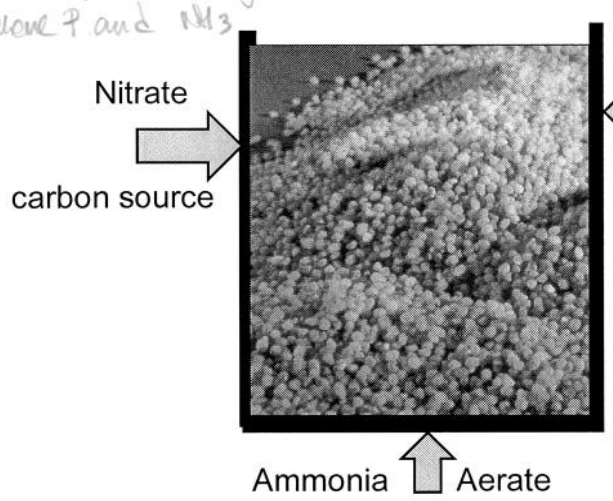

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