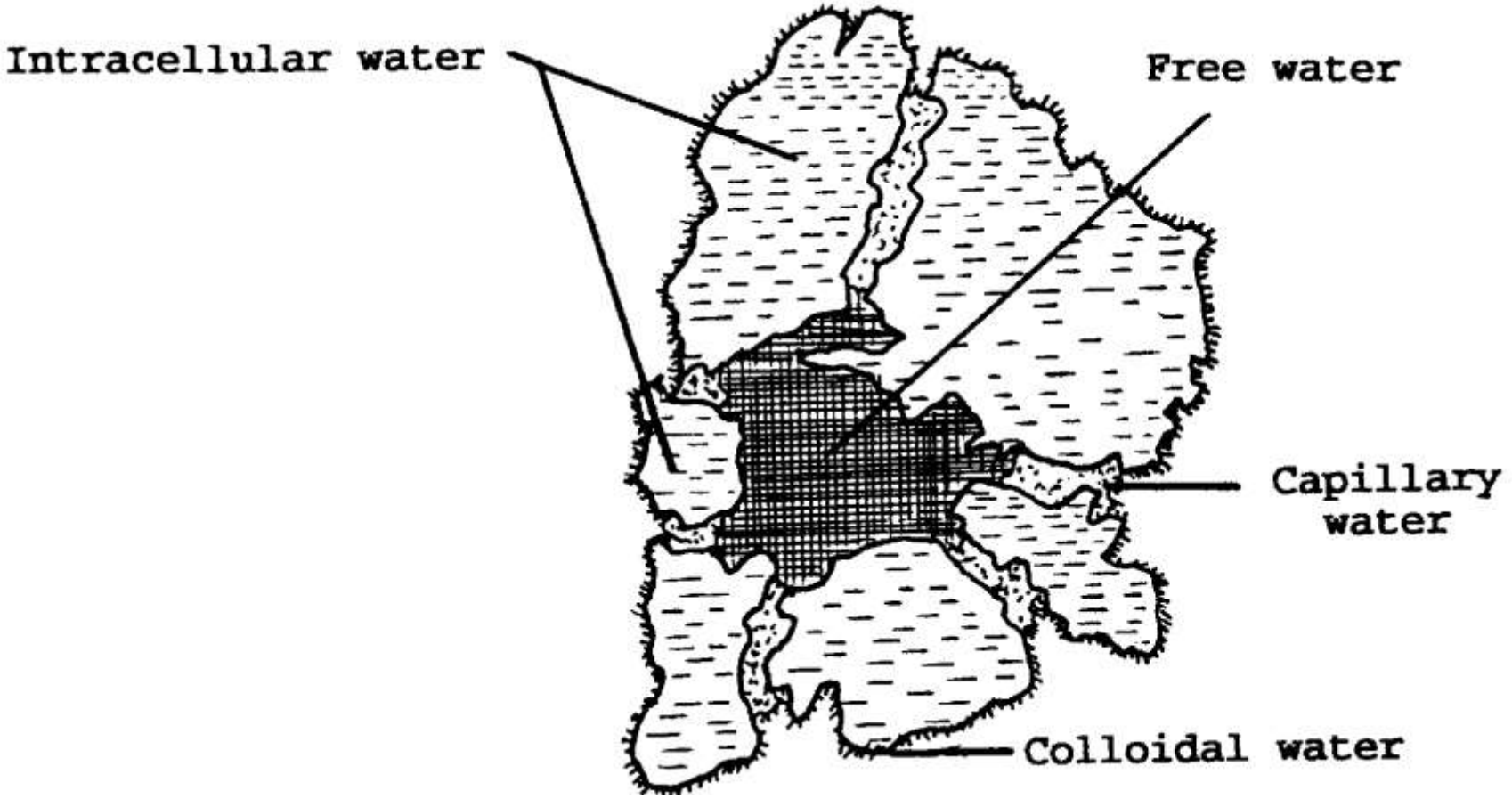
Dewatering:
past, present and future



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AquaEnviro

Impact of sludge type on polymer dose and % dry solids

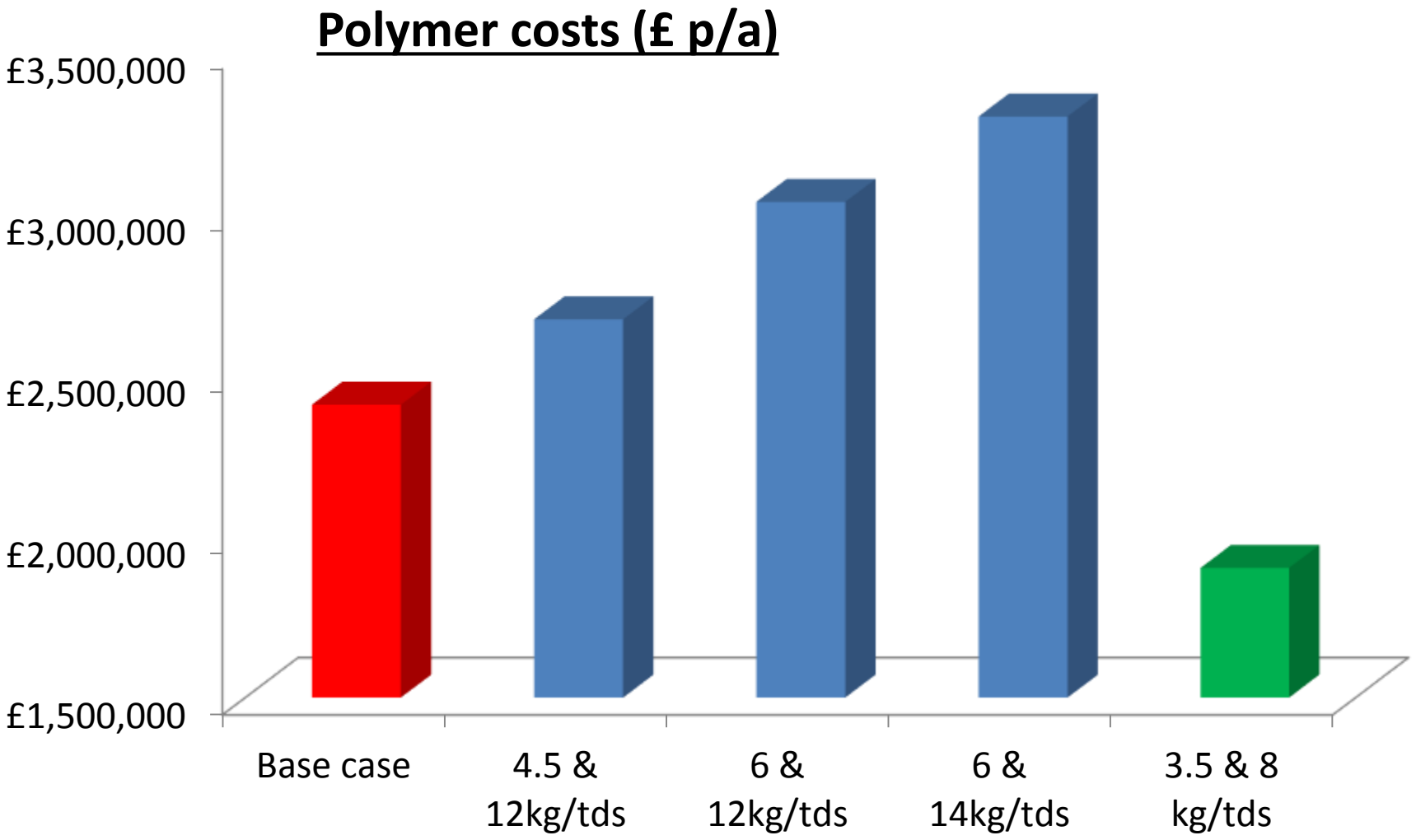
Sludge Type	Dose (kg/tds)	Cake solids (% DS)
100% primary	2-4	30-40
67% primary : 33% secondary	3-5	25-35
67% secondary: 33% primary	6-8	20-25
100% secondary	7-12	15-20
Conventional digested	3-8	20-28
THP digested	8-15	26-32 (45%….)

Polymer

Yorkshire Water – ‘The thickening process is a major contributor to regional chemical consumption costs as well as the link in movement and treatment of sludges across the region’.

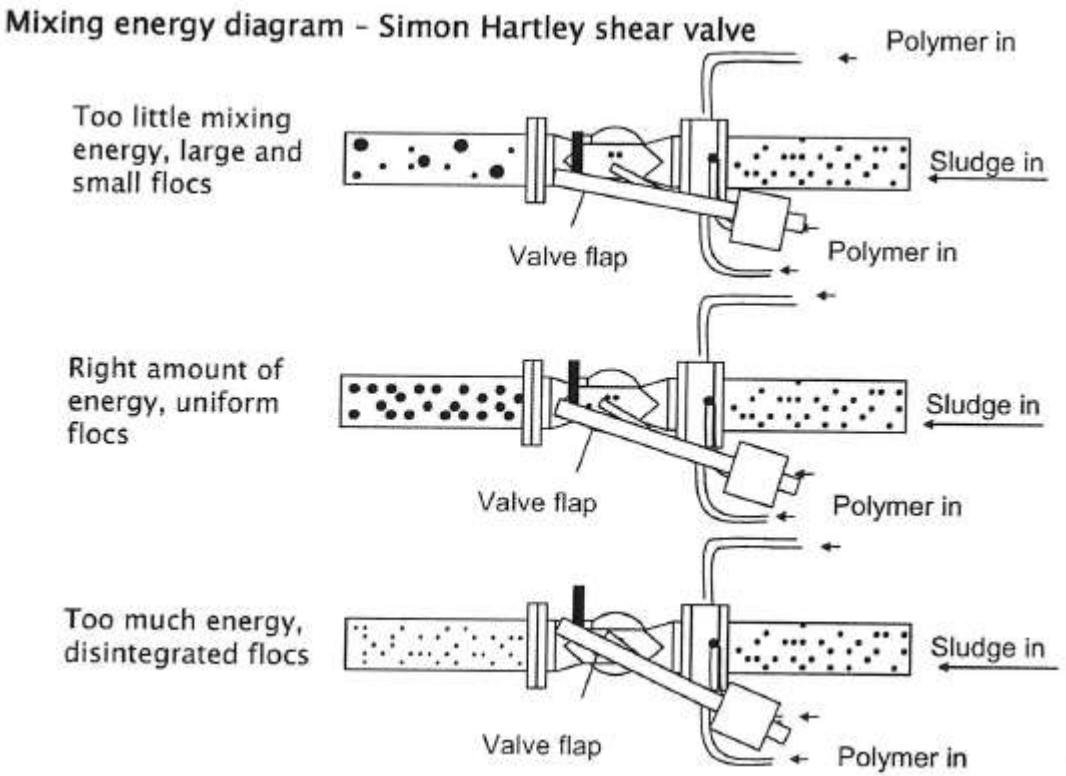
Stage	TDS p/a	Kg poly/tds	t.Poly p/a	£ p/a
Pre-dewatering	121,000	4.5	544.5	1.09
Digestate	66,000	10	660	1.32
				£2.41 million

Sensitivity Analysis



Many considerations

- Polymer type (charge density, molecular weight, structure)
- Stability (alkalinity, pH, temperature, age)
- Carrier (not mixing) water
- Polymer make up time
- Solution concentration
- Dose point
- Liquid versus powder
- Mixing energy
- Sludge composition
- Age of sludge (and poly)
- Shearing



TWUL Asset Standard (Belt Dewaterer)

Sludge Type	Hydraulic Load (m^3/m/hr) Maximum Allowable	Solids Load (kg/m/hr) Maximum Allowable	Polymer Dose (kg/TDS) Guarantee Maximum	Output Dry Solids (%DS) Guarantee Minimum
Raw Primary & Co-settled Primary/Humus Sludge	15	450	6	28%
Raw Mixed Sludge (<=50% SAS)	12	450	6	24%
Raw Mixed Sludge (50-70% SAS)	10	400	7	20%
After Conventional Digestion (<=50% SAS in digester feed)	8	350	7	21%
After Acid Hydrolysis & Digestion*(<=50% SAS in digester feed)	8	350	7	23%
After Thermal Hydrolysis & Digestion**	10	600	10	30%

Davyhulme (SBAP)

Parameter	Value	Units
Maximum daily sludge inlet flow	2,357	m3/d
Polymer dose	10	kg/tds
Polymer make up concentration	0.5	%w/v
Polymer dilution concentration	0.1	%w/v
Typical daily polymer flow (diluted)	1,132	m3/d
Maximum daily polymer flow (diluted)	1,610	m3/d
Typical thickened sludge flow	323	m3/d
Maximum daily thickened sludge flow	323	m3/d
Typical centrate flow	2,424	m3/d
Maximum daily centrate flow	3,057	m3/d

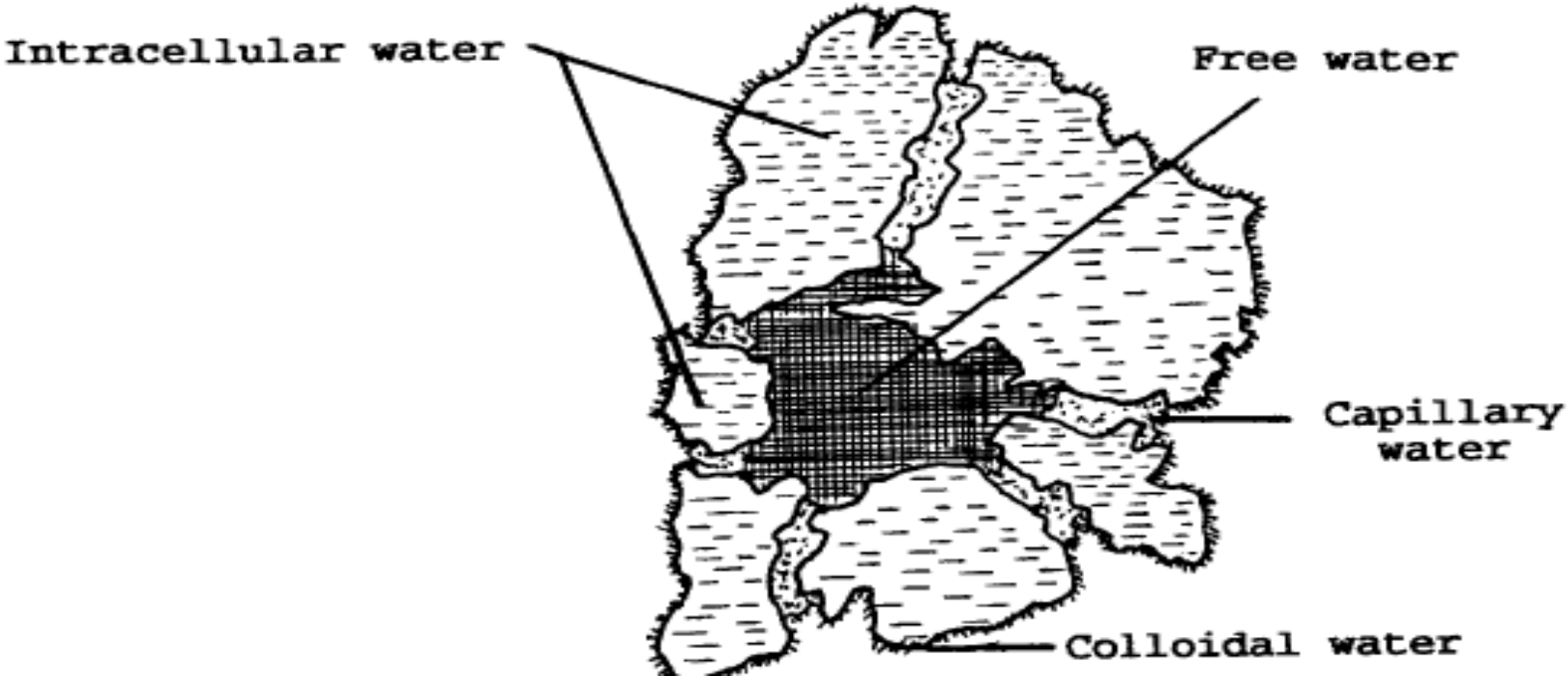
Volatile solids

VS Content (%)	Target Dewatered Cake Solids (% DS w/w)
55.8 to 62.7	27
< 55.8	28.5

Take-over testing

	Unit	Centrifuge	FBP
Product	%DS	As specified by THP specialist sub-contractor	Average >28% Minimum >25%
Solids capture	%	≥95 see note below	≥90
Polymer Dose rate	kg/t DS	≤4.5	≤6.0

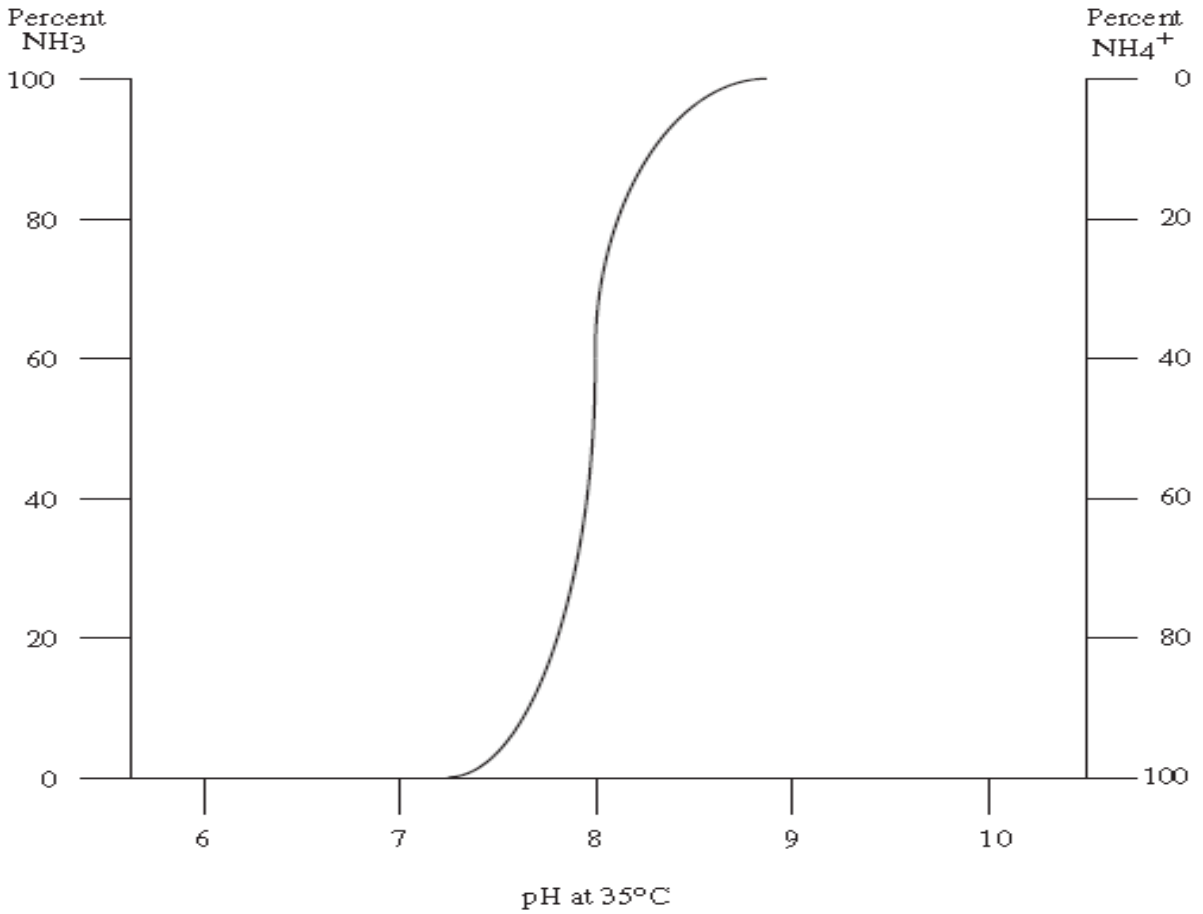
Food Waste Digestion



Baddeley, A., Ballinger, A., Cessford, I. & Smyth, M (2014). Assessing the Costs and Benefits for Production and Beneficial Application of Anaerobic Digestate to Agricultural Land in Wales (OMK007-203). *WRAP.*

Ammonia

$$NH_4^+ \longleftrightarrow NH_3 + H^+$$



Return Liquor Quality

Parameter (mg/l)	Range of Concentrations
BOD	500 – 15,000
COD	1,000 – 30,000
TSS	300 – 20,000
NH_4-N	600 – 1,000
Total – P	20 – 200
Alkalinity	80 – 200
pH	5 – 6.5

We know quite a lot, but every plant and every combination of sludges are different

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