

Keep your Pond

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Marshall Projects
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The Presentation

- Marshall Projects
- Bioshells
- The Clutha Project
- Results to Date
- Conclusions
- Questions

Marshall Projects

- Established 2005 – Tom Marshall
- Installing MF since 1998
- Twelve MF plants in NZ
- Recently:
 - Exclusive Rights to Bioshell/Biodome Technology
 - Manufacture in NZ (Invercargill)
 - Installed in Clutha Project

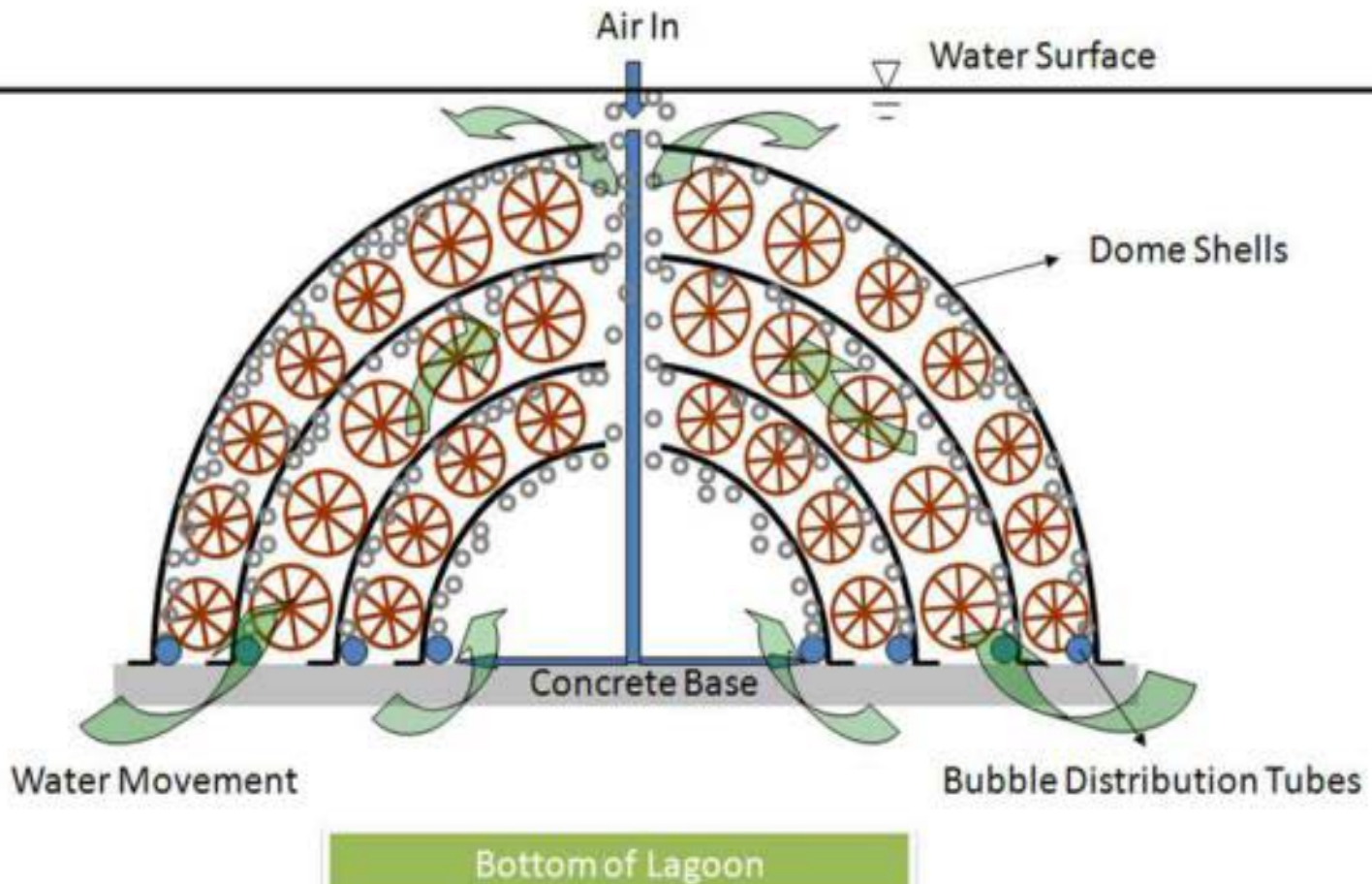
What are Bioshells?

- Submergible Aerated Bio-Film Reactors
- Used in Augmentation of Stabilisation Ponds to reduce:
 - BOD
 - Suspended Solids
 - Ammonia
 - Potentially Nitrate & Phosphorous – (being worked on)

Key Benefits

- Modular – add when needed
- Low energy
- Nitrify as low as 0.5°C
- Keep Asset – Pond
- Proven – University of Utah – Professors
 - Kraig Johnson
 - Larry Reaveley
- Low Cost

Physical Characteristics



Design Performance

- BOD (kg/day/unit)
 - 4 layer Bioshell – 6.9
 - 2 layer Bioshell – 1.8
- SS (kg/day/unit)
 - 4 layer Bioshell – 2.6
 - 2 layer Bioshell – 0.7
- Once pond BOD & SS < 30mg/L – Use for nitrification

Design Ammonia N Performance

- Temperature Dependant
- Ammonia Removal
 - 2-Layer Bioshell (kg/day/unit):
 - 4-6°C – 0.08
 - 6-10°C – 0.11
 - 4 – Layer Bioshell (kg/day/unit)
 - 4-6°C – 0.3
 - 6-10°C – 0.4

Bioshells - Air

- Low rate of air
- Air acts as a lift pump for circulation
- 1 scfm per 2 layer Bioshell
- 3.5 scfm per 4 layer Bioshell
- Pressure to overcome losses and static
- Side channel blower sufficient for Clutha Plants

Clutha Project Overview

- Client – Clutha District Council
- Project Driver – new consent requirements
- Process Chosen – Bioshells and Microfiltration
- Two ponds – Kaitangata and Heriot
- \$1.93m for both sites

Clutha Overview

- Kaitangata
 - 15 Bioshells (2 layer)
 - Pall AP4 MF system
 - Building – 6 by 11m
- Heriot
 - 7 Bioshells (2 layer)
 - Pall AP2 MF System
 - Building – Transportable – 3.3 by 7.9m
- Baffles added to both ponds

Timeline

- Contract Awarded Mar 17
- Heriot Commissioned Feb 18
- Kaitangata Commissioned Mar 18
- Unusual delays (container being dropped at wharf!)

Performance to Date

- Heriot – Feed into pond excessive in loading
 - Truck Wash (historical data does not include)
- Nitrification inhibited due BOD/SS Loading
- Heriot Discharge
 - MF successful in removing:
 - BOD
 - SS
 - E-Coli
- Results – April to August 2018 (50thile)

Heriot Summary

Parameter	Influent	Pond Effluent (pre-upgrade)	Pond Effluent (post Upgrade)	Discharge	Consent Requirement
BOD (g/m ³)	124	37	72	8	20
Ammonia N (g/m ³)	40	16	41	41	20
TSS (g/m ³)	160	52	125	<6	20
TN (g/m ³)	54	?	59	42	35
TP (g/m ³)	9.6	8	14	10	10
E-Coli (cfu/100ml)	4,300,000	69,000	178,000	<5	260

Kaitangata Performance to Date

Parameter	Influent	Pond Effluent (pre-upgrade)	Pond Effluent (post Upgrade)	Discharge	Consent Requirement
BOD (g/m ³)	68	47	31	<6	20
Ammonia N (g/m ³)	20	15	18	18	20
TSS (g/m ³)	125	76	45	<6	20
TN (g/m ³)	28	?	25	20	35
TP (g/m ³)	3	6	4	2	10
E-Coli (cfu/100ml)	643,000	81,000	20,000	<5	260

MF Performance

- Pond Effluent is difficult to filter
- Temperature through winter <5degC
- MF Quality:
 - Removing TSS/E-Coli
 - Removing insoluble BOD
 - Removing Insoluble N & P (TN = Ammonia N)
- Capacity – reduced during winter

Conclusions

- No nitrification at either pond – due BOD & SS >30mg/L – YET.....
- Bioshells reducing BOD & SS (Kaitangata Results)
 - BOD 0.7-0.9kg/shell/day
 - SS 1.2-1.4kg/shell/day
- Data set due pond size not definitive
 - Design BOD 1.8kg/shell/day
 - Design SS 0.7kg/shell/day

Conclusions ctd

- MF will filter and mask pond performance
 - Surety of:
 - TSS;
 - BOD;
 - E-Coli
 - Assistance in TP/TN with insoluble removed
- When BOD/SS >30mg/L:
 - MF capacity/Flux Decrease (35-40lmh to 20lmh)
 - No Nitrification

Conclusions ctd

- Historical Data
 - Feb and August Only
 - This year, very cold, June < 4degC
 - Pond performance in June/July worse than historic August
- Operating Costs
 - Power & Chemicals – \$0.12/m³
 - Remote monitoring/Operations - \$3,700/mth
 - After time labour reduced to \$1,000/mth

Next Steps

- Heriot – Truckwash removal/pre-treat/pond augmentation
 - As yet undecided
- Kaitangata
 - Quality achieved
 - More Bioshells to cater for winter performance – assist MF – BOD/SS - & prove nitrification at low temp
 - More membranes to cater for capacity when pond performance poor
- Refine Design/Optimise

Questions

