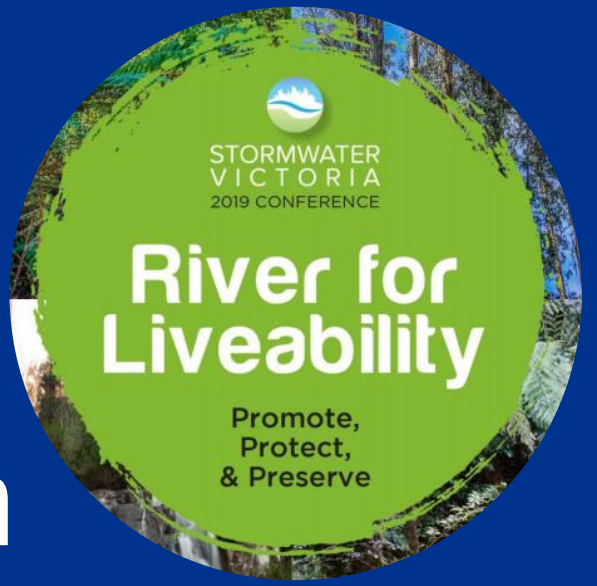

Irrigating food crops with stormwater

A review of potential risks

Vaughn Grey & Belinda Hatt

JACOBS

Moreland City Council

Mutton Reserve

MUTTON RESERVE | Fawkner

Client	Moreland City Council		
Drawing No	T38062_LDS02	Revision	A
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Shiels Reserve

What are the contaminants of concern in stormwater?

What are the water quality requirements for irrigation of food crops?

Will pollutants accumulate in the edible parts of food crops?

What operational considerations might we need to think about?

Contaminants of concern

decreasing importance

Environmental protection		Stormwater harvesting
Nutrients	✓	Faecal pathogens
Heavy metals	✓	Micro-pollutants
Sediment	✓	Heavy metals
Oxygen demanding	✓	Hydrocarbons
Hydrocarbons	✗	Nutrients
Micro-pollutants	✗	Sediment
Gross pollutants	✓	Oxygen demanding
Faecal pathogens	✗	Gross pollutants

Contaminants of concern

Chemical & microbial quality of stormwater

- 10 locations
- Melbourne, Sydney, Brisbane, Perth
- Considered catchment size, age, land-use and climate
- Public health standards

- Metals 👎
- Pesticides 👍
- Pharmaceutical and personal care products 👍
  - exception: caffeine 👎
- Endocrine-disrupting chemicals 👍
- Industrial chemicals 👍
- Pathogens 👎

Exposure pathways

- Contact with harvested stormwater
- Consumption of produce that has been irrigated with stormwater

Water quality requirements

Tolerable pathogen level and treatment requirements for the irrigation of commercial food crops

Reference pathogen	Tolerable concentration (infectious units per L)*	Required reduction	
Rotavirus	0.0051	99.5%	2.3 log
Cryptosporidium	0.016	98.2%	1.7 log
Campylobacter jejuni	0.078	99.5%	2.3 log

*Exposure = 490 mL/yr

Exposure controls

Reference pathogen	Required reduction
Rotavirus	2.3 log
Cryptosporidium	1.7 log
Campylobacter jejuni	2.3 log

- On-site non-treatment barriers
- Treatment after collection

Control meausre	Reduction in exposure to pathogens
Drip irrigation of crops	2 log
Subsurface irrigation of above-ground crops	4 log
No public access during irrigation and limited public contact following irrigation	3 log
UV disinfection	>1.0
Reverse osmosis	>6.0
Raingarden	0.7 – 1.7

Will pollutants accumulate in plants?

- PhD study – can we combine food production and stormwater treatment?

- Root, leafy and fruiting vegetables
- Active and passive planting
- Investigated plant uptake of heavy metals and pathogen

- kay.ng2@monash.edu

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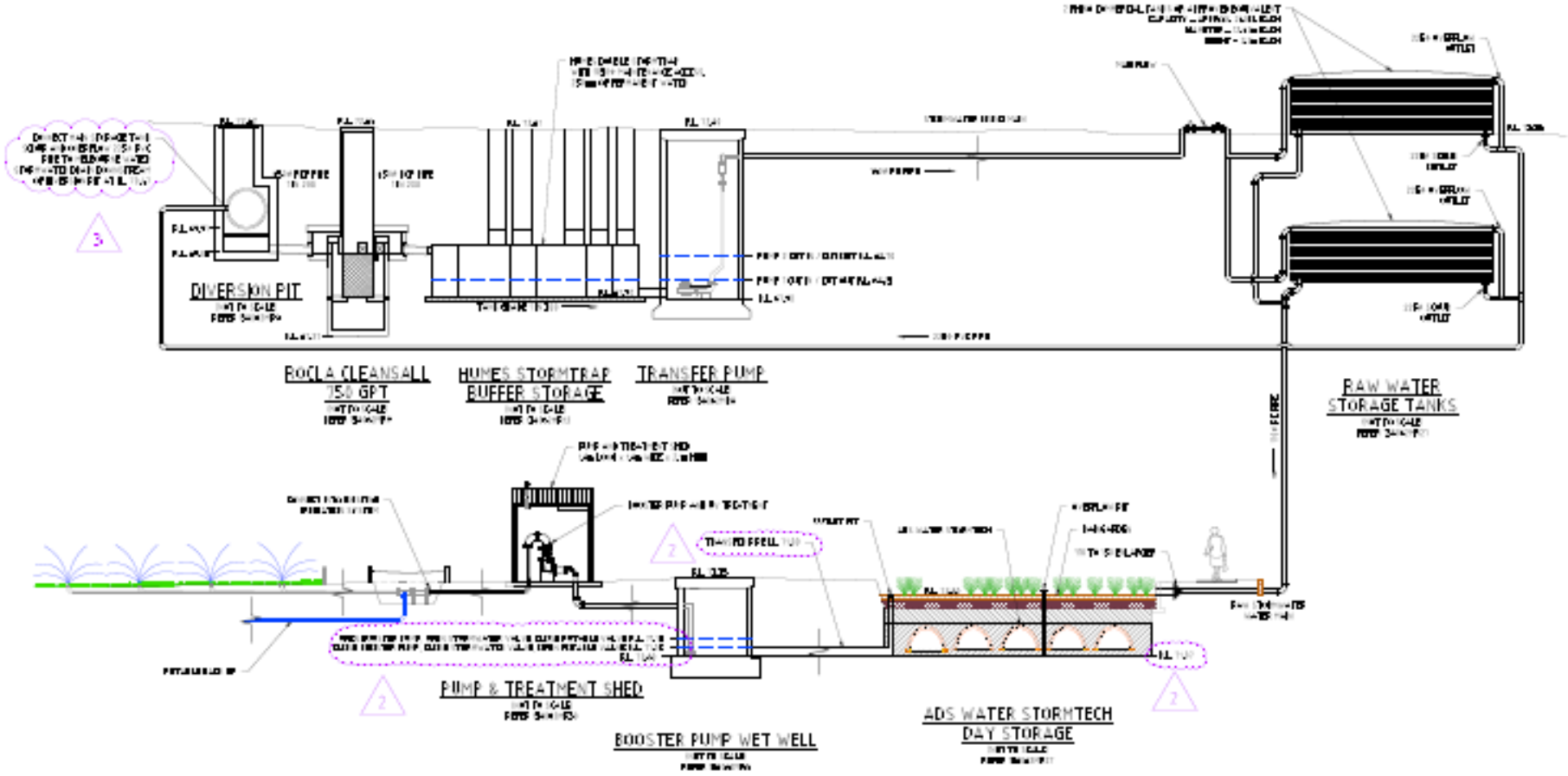


Mutton Reserve

Stormwater harvesting scheme	Exposure control	Indicative reduction in exposure to pathogens
Mutton Reserve	Gross pollutant trap AND	0
	Tank AND	ID[b]
	Raingarden AND	0.7 - 1.7 log[c]
	Tank AND	ID[b]
	UV disinfection	>1.0
	TOTAL	1.7 - >2.7 log

[b] ID – insufficient data
[c] (Chandrasena et al. 2017)

Shiels Reserve

Shiels Reserve

Stormwater harvesting scheme	Exposure control	Indicative reduction in exposure to pathogens
Sheils Reserve	Pond AND	0.5 - 1.0 log
	Overland (above ground) irrigation of crops with no ground contact OR	0.5 - 3 log[a]
	Sub-surface irrigation of above ground crops (orchard)	4 log
	TOTAL	1 - 5 log

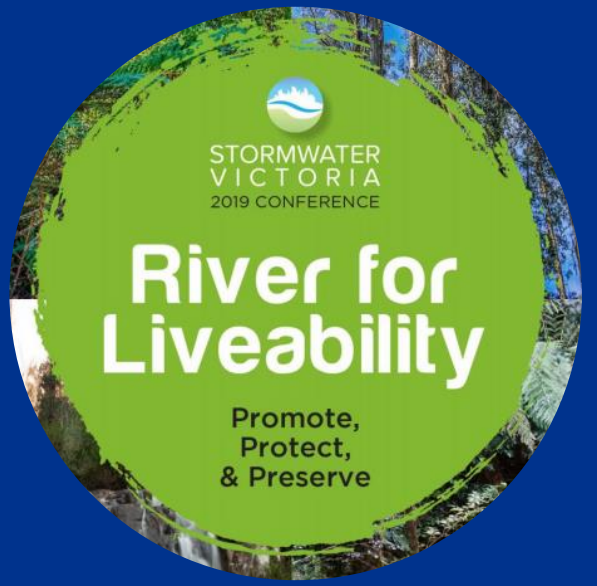
[a] If combined with one of the following control measures: withholding periods – produce (decay rate): 0.5 log/day; no public access during irrigation and limited contact after: 3 log

Operational considerations

- Potential for contamination of produce via atmospheric deposition
- Include a mechanism for responding to hazardous events
  - e.g. major fire in the catchment, accidental spills or discharges
- Potential for algal blooms to occur in open storages
- Community acceptance

Conclusions

- Pathogens and heavy metals
- Risk management relatively straightforward
  - Preventing contact with harvested stormwater is key
- Possible to irrigate with minimal to no pre-treatment
  - BUT need to pre-treat if growing root crops
- Important considerations:
  - Community education
  - Incorporating a bypass system



Thank You!

vgrey@moreland.vic.gov.au
belinda.hatt@jacobs.com

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