Institute for Sustainable Futures

DECENTRALISED WATER SYSTEMS – Creating conducive institutional arrangements

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Decentralised water systems make economic & environmental sense

Slowly being taken up across Australia

- Points in favour of decentralisation
- Drivers and enablers
- Comparing and contrasting Australia & US
- Recommendations - steps Australia might take

Definitions

- on-site: treatment technologies and/or management on an individual lot
- decentralised: treatment technologies and/or management systems at the scale of multiple buildings
- distributed: treatment &/or management systems in multiple locations across a community, either decentralised or on-site

Advantages of decentralised systems economic & environmental

- Allow smaller sewers
- Staged development
- Lower LCA outcome
- Local reuse
- Community engagement
- Smaller consequences of failure

Caveats
Some cautionary points

- Lose economies of scale in treatment
- If management not tops – risk of failure

US Experience

USEPA Study - why take-up in USA is slow

Etnier et al. 2007


financial reward for centralised systems


lack of knowledge


unfavorable regulatory systems


lack of systems thinking

US Experience cont'd

USEPA encourages decentralised systems

60m people served by distributed systems

Typology developed –

- RMEs = responsible management entities
- Levels 1 to 3 – on-site systems
- Levels 4 & 5 – distributed and decentralised systems

US experience cont'd

- Level 4 RMEs responsible for O&M - Property owners own treatment system
- Level 5 RMEs own treatment systems & do O&M
- Level 5 RMEs – mostly new developments – developer builds, then hands over to RME (Yeager et al.)

US experience cont'd

- Single L4 or L5 RME – 100s to x10k connections
- Some work in 1 jurisdiction - others in multiple states
- Variety: public/private business models & institutional arrangements
- Arrangements contextual - local regulations and implementation - differ state to state & sometimes county to county

Types of RME in US
(Yeager et al. 2006)

- private companies (profit & not-for-profit)
- not-for-profit rural electric cooperatives moved into wastewater business
- ‘special purpose districts’ - sewage services, often with others
- public authorities e.g. county, municipality agencies & governments

Private RME examples

- Business models for local regulatory context
- Adenus group - one of largest
- Around 30,000 households in 3 states
- Privately-owned, for-profit, publicly regulated utility

The Waters

Location – Montgomery, AL
Area – 1,250 acres
Units – 2,500 residential units
Product Type - Traditional Neighborhood Community surrounding a 200 acre community lake.
Master Plan – 8 distinct Hamlets (i.e. stand-alone communities), including approximately 350 residential units and commercial uses each
Topography – Gently rolling
Soil – Prairie gumbo clay

Collection System – site topography allows for individual STEG versus STEP systems

Treatment - Recirculating Sand/Gravel Filter; built in phases

Disposal:

- Drip Irrigation – built in phases
- Storage Pond – reduce drip irrigation installation costs and land application area.

Public RMEs

- Advantages - greater legal powers to respond to unpaid bills, e.g. turn water off, and to gain access, easements etc. for maintenance.
- Leading example - Loudoun County Sanitation Authority (LCSA)

LCSA

- Loudoun County - suburb of Washington DC
- LCSA - w & ww service to unincorporated parts of county
- ~ 53k connections (Danielson 2008)
- Historically - urbanised areas & centralised systems
- Policy - rural areas only have on-site or cluster systems

Loudon County Sanitation District

- Recently - cluster systems: ownership & contract operations
- Decentralised ww facilities - schools, parks, recreation facilities & towns
- System violations down to near zero
- LCSA's benefits - economies of scale of large customer base

The Broad Run Water Reclamation Facility

US issues

- For income certainty - RME needs ongoing contractual arrangement - often linked to property
- Key feature in USA - RME L4 & L5 – little or no competition for service provision
- Prices set by public utility commission - onus on RME to demonstrate costs of service & argue
- Commissions set rates for publicly owned, for-profit utilities, not for government, quasi-government & non-profit businesses
- Indications - lack of effective pricing systems is major barrier to successful outcomes in USA.

Comparing USA & Australian practice

- Australian situation different to USA
- Decentralised systems not as common
- Push factors - ‘how’, rather than ‘whether’
- Pull factors - aspirational
- Identify:
  - enablers
  - business models
  - lessons for Australia

Drivers (push factors)

- Initially - hard-to-service pockets in larger communities
- Decentralised approach enabled business to extend services, esp. sewerage
- Now - trend to medium density - putting services under strain - key driver for future decentralised systems
- Another key driver - aging infrastructure and overloaded main sewers

Examples

- Whites Road – Brisbane - example of hard-to-service area
- Commercial imperatives for developers
- Aurora (8,000 lots) Melbourne - lack of trunk sewers
  - VicUrban committed to sustainable land release
  - Result for water system - strong efficiency & development scale residential recycling
  - Owned & operated - Yarra Valley Water

More examples

- Payne Road (22 lots) Brisbane - lack of sewer capacity
  - Body corporate - ongoing management of decentralised technologies - rain tanks, fire fighting system, greywater treatment & subsurface irrigation
  - Take-up of house & land packages slower than hoped - may be premature to judge success of model
- Noosa North Shore Eco Resort - development employs decentralised features (rainwater tanks and MBR to recycle effluent)
  - Noosa Council declined to extend centralised services across river

Noosa North Shore Eco Resort

- 250 private residences
- On-site wastewater treatment and recycling system by EcoNova - $1.47m
- Commissioned Dec 2005
- Aerobic MBR - high-quality A+ (EPA Qld)
- All wastewater (black- and greywater combined)
- Up to 240 kL/d
- Reclaimed water – toilet flushing, laundry, garden watering, & car washing

Membrane Bioreactor (NovaClear™ single household unit)

Drivers (pull factors)

- Strong pull factor - passionate commitment of proponents
- Sydney Olympic Park - strong green credentials - overcame many hurdles to set up WRAMS
- Currumbin Ecovillage (Queensland) - championed by committed individual
- Green building rating systems (Green Star Rating) system
  - Profile value of high rating recognised by developers

Currumbin Ecovillage

http://www.envirodevelopment.com.au

Enablers

- Existing practices and systems can undermine change - enablers needed to overcome
- Supportive institutional climate - strong enabling factor
- Planning permission
- Regulatory authorisation as water business
- All other bureaucratic approvals can be enablers if +ve
- All but insurmountable barriers if -ve

Enablers cont'd

- Authoritative guidelines legitimise decentralised systems
- Sydney Water (2006) - new sewer mining guidelines
- NSW Government (DWE 2007) - interim guidelines - recycled water schemes
- Guidelines - framework to manage human health & environmental risk
- Internationally – WHO (2005) guidelines for the reuse & recycling of human faecal matter

NSW *Water Industry Competition Act 2006 No 104*

- Most significant!
- Express purpose - to promote economically efficient use & operation of, & investment in, significant water industry infrastructure, promoting effective competition in upstream or downstream markets
- Major step - opened door to decentralised systems
- The WICA 2006 - three key measures:
  - Licensing regime for private sector participants
  - Access regime for storage & transport of water & sewage using existing significant water & sewerage networks
  - Binding arbitration of sewer mining disputes

Costing methods

- Objective costing methods needed
- Find least cost solution
- Organisational $ perspectives + whole-of-community basis
- Guidebook by Mitchell et al. (2007)
- Principles from economics, systems, and risk management - meaningful comparison of technologies across primary divides of:
  - supply & demand
  - decentralised & centralised infrastructure

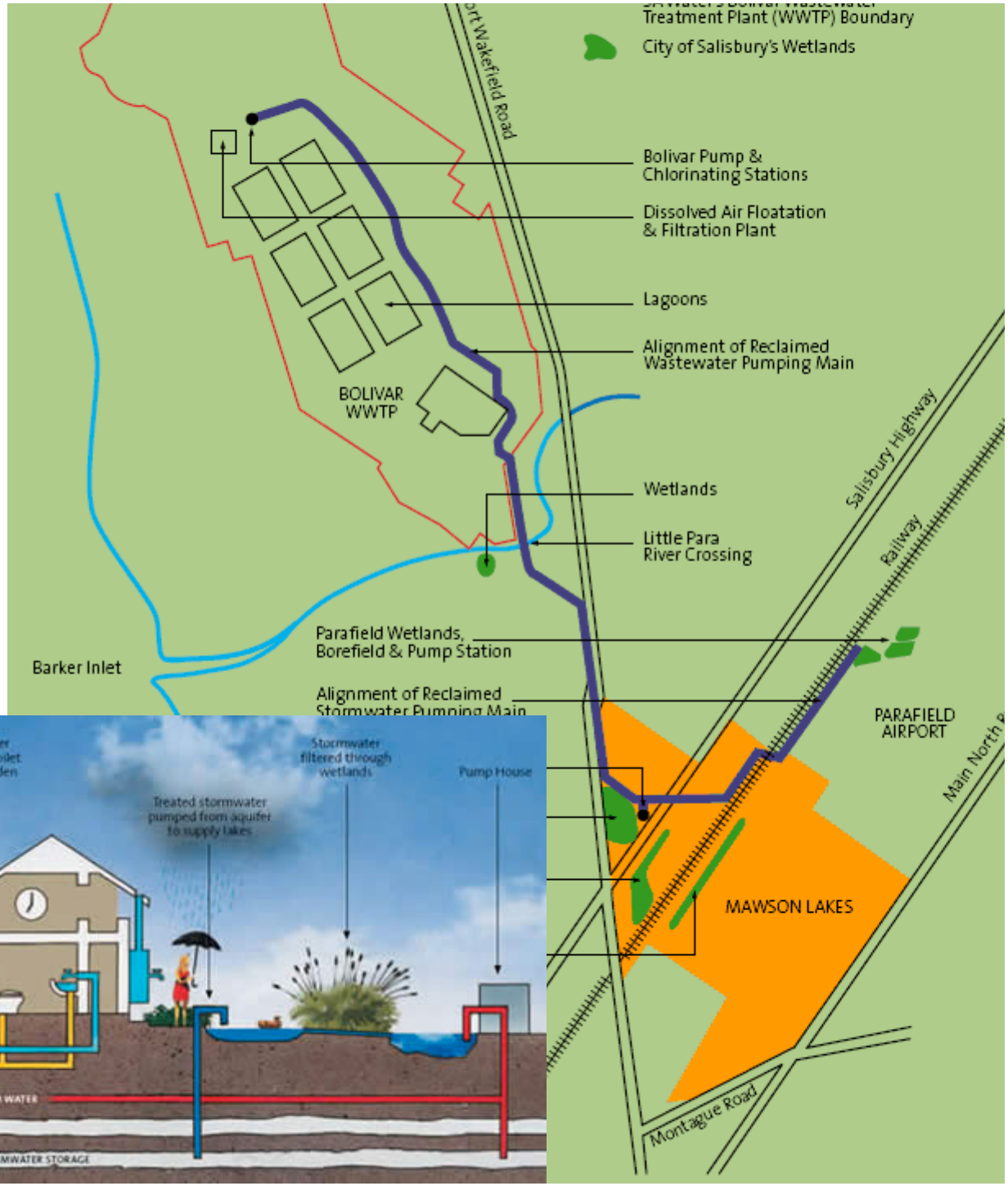
Business models

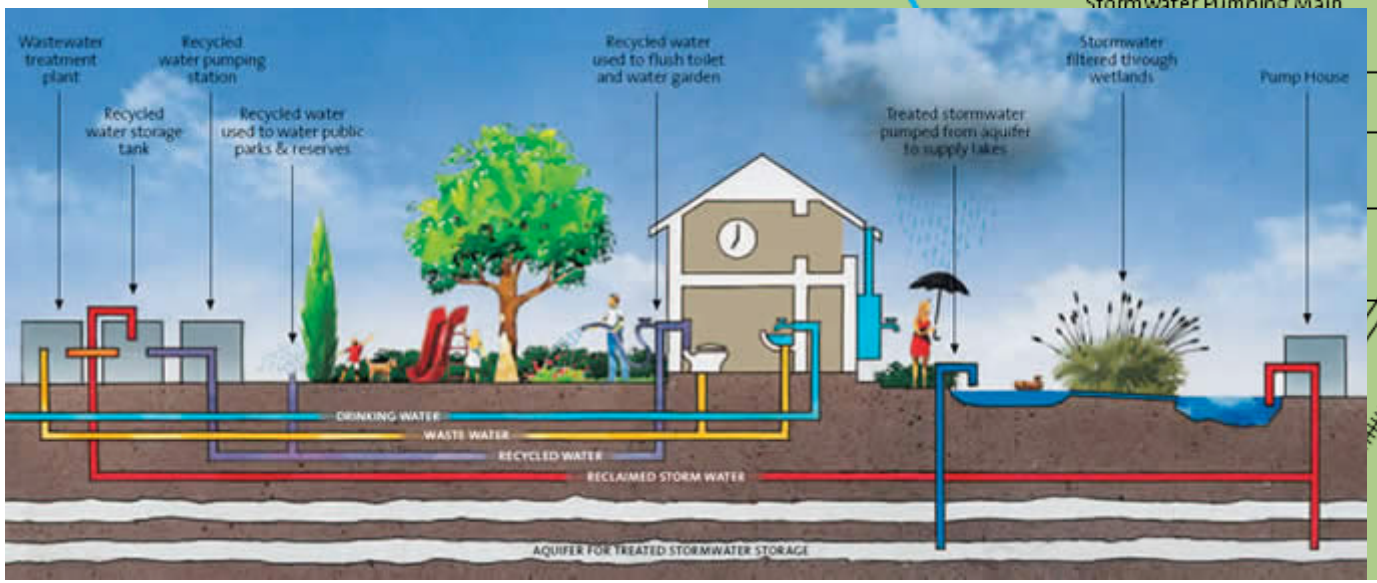
- Narrower range than USA
- Generally, decentralised systems by developer or utility
- Some departments of state, territory or local gov’ts
- Others, especially larger ones - corporations, with government shareholders, paying dividends
- Many Australian decentralised ww systems initiated as JVs between governments & developers
- Ownership, O&M often by water utility

Mawson Lakes

JV Delfin & SA Gov't

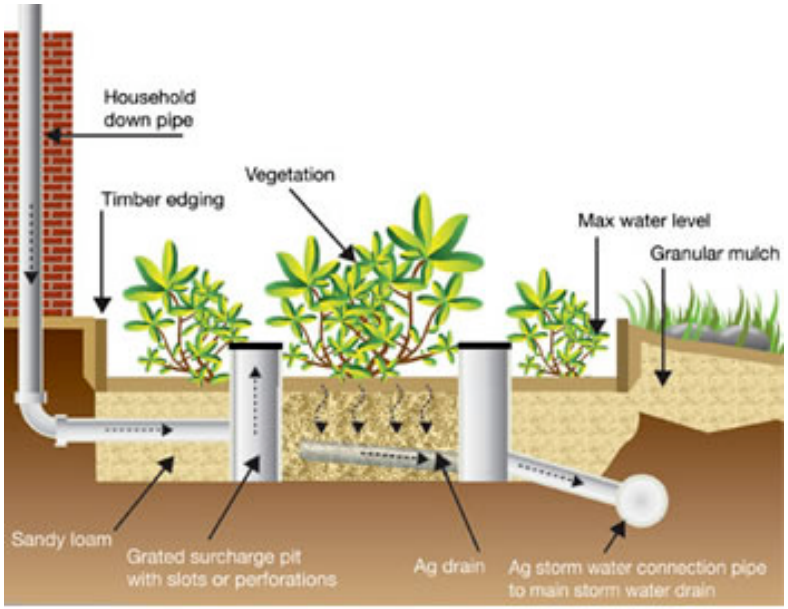
Water infrastructure owned & operated by SA Water





Some examples

- Aurora Melbourne →
  - VicUrban water infrastructure
  - managed by Yarra Valley Water
- Pimpama Coomera WaterFuture
- Masterplan (Qld) developed by Gold Coast City Council
  - Run by Gold Coast Water
- Sydney Olympic Park - stormwater and wastewater reclamation system owned by SOPA
  - SOPA ia water supply authority
  - 25-year agreement with company for O&M of treatment plants



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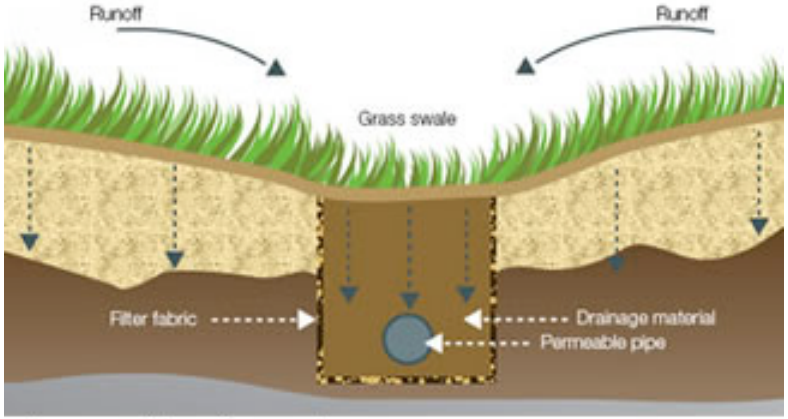

Cross-section of a swale.

Evolution

- Could change with WICA - allows privately owned RMEs to become major players

- Alternatives already emerging - Currumbin Ecovillage: water infrastructure owned by body corporate but O&M by contractors

Lessons for Australia

- To get benefit of decentralised systems - appropriate institutional arrangements needed
- Where linked to centralised networks, even if only for emergency: access, pricing & ‘service provider of last resort’ arrangements needed
- Must ensure ‘host’ utility can recover costs incurred by link to decentralised system
- Pricing for access regime must enable viability of decentralised operator
- Transparent accounting for both costs incurred & cost avoided needed (including augmentations)
- Centralised management of distributed systems - crucial

More lessons

- Enablers for decentralised systems: good protocols for planning and approval, plus frameworks that encourage business model variety
- Decentralised systems - more flexible business models than postage stamp pricing
- NSW WICA - potential for variety of viable business models for decentralised wastewater, but issues still
- Given complexity of challenges - additional research and analysis will be critical

CONCLUSIONS

We need:

1. enabling legislation & government policies – e.g. NSW Water Industry Competition Act 2006
2. wider range of business models; flexible & adaptable, enabling effective market, including private RMEs & publicly owned businesses
3. pricing, operating & supervision arrangements which ensure stability of whole system; including centralised & distributed systems

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Thank you