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Brisbane Catchments Network

"A healthy and biodiverse Brisbane"

Urban Nutrients and Pollution Reduction in Moreton Bay Workshop
7 July 2016
Workshop Summary Report

Introduction

Mik Petter – B4C

In the upper catchment we are already addressing sediment reduction (e.g. SEQ Catchments). However, a lot of diffuse pollution is entering Moreton Bay through the urban waterways. Some of Australia's highest biodiversity values and areas are located in our urban waterways. A Brisbane Catchments Network (BCN) led group is seeking to restore ecosystem health of our waterways. BCN is seeking relevant research to link strategically to our management plans. How much do the community invest in on-ground actions for nutrient reduction? We need to prioritise catchment plans. We will seek to progress this Project in the long-term.

Partha Susarla

Unitywater – ***From Grey Infrastructure to Green Infrastructure in Nutrient Management***

Unitywater is a statutory authority that provides water and sewerage services to the Moreton Bay, Sunshine Coast and Noosa local authority areas on behalf of their citizens. They operate water and sewerage infrastructure:

- Sewage Treatment Plants (STPs) (17)
- Pumping stations (77)
- Water and sewer networks (11,000km)
- Maintaining water quality
- SCADA system.

Unitywater's current focus is "how to reduce the financial burden for our customers".

Grey to Green Infrastructure - Green Infrastructure costs 20% of hard infrastructure solution on an equivalent basis.

Caboolture River Nutrient Management Works:

- 4 sites in total, in which most of the land in private ownership
- Due to be completed in 2017

Pine River Restoration being planned for 2017 to 2019.

Maleny Wetlands
Waterwise Catchment – Waterwise Town

Wamuran Recycled Water Irrigation Scheme:

- Total Area 6,000 ha
- Existing Cropping Area 2,430 ha
- Potential Additional Cropping Area 1,300 ha
- **Potential New Farm Gate Revenue** **$210M + per annum**

Health of Moreton Bay:

- Resilient Rivers Initiative
- Regional Stewardship
- Upper Brisbane Catchment Management and Improvement
- Erosion and Sediment Control
- Custodian approach
    - Three levels of Government/Water Service Providers/Others – Port of Brisbane

Andy Hornbuckle
SPEL Environmental – ***Floating Treatment Wetlands***

SPEL Environmental Australia
- 10 offices in Asia Pacific
- 50% of business is in service station water collection and treatment
  Less than 1 ppm of hydrocarbon runoff from Service Stations versus 15 ppm off Shopping Centres
- 50% of business is Water Sensitive Urban Design (WSUD)

Modular Bioretention
- Horizontal flow
- Retain water below ground
- Control of outflow to streams
- New observation lids (Baffle boxes)
- CRC for Water Sensitive Cities – UN Standards

Primary Treatment - Gross Pollutant and coarse sediment (>5mm in size) traps:
Work is complete underground and is not visible to the community
Signage and clear covers to show it being doing
However the community can see council does not maintain them

Primary Treatment
- SPEL Ecoceptor
- SPEL Baffle Box

Secondary Treatment
- SPEL Puraceptor
- SPEL Stormceptor

Specialised Technologies
- SPEL Osorb

Floating Wetlands – nothing new (naturally occurring) – Lake Titikaka (Peru)

Floating wetlands:
- Working within a stream or an asset
- Oldest SPEL floating wetland system in the USA is 18 years, Asia Pacific oldest SPEL system is 8 years old
- Biomimicry – copying nature / plant roots and microbial activity
- Fixed Filmcomplex ecosystem – supports over 3,000 species of microbes and provides a controlled wetland effect
- Hotel Hilton for the microbes!
- Plant roots as a living system in the water column that is hosting the microbes that do the work to filter the water
- Layer of oxygen in root area – microbes work better
- 1 cu m of active plant roots – 10,000 sq m surface area
- 1 cu m of blue green algae – 4,000 sq m surface area
- Floating wetlands can win over algae
- Four layers of 50mm matrix for ephemeral conditions to be mastered
- Biofilm on plant roots
- Example of a natural wetland system – Lake Titikaka (Peru)
- Local Project – Bribie Island

Comparisons to conventional wetlands:

- More than triple surface area in the same area to treat the water
- Made out of recycled PET bottles
- Pilot in Asia
- 4 layers of 50mm matrix to make up the 200mm module
- Took 7 years to perfect
- Biofilm on plant root to remove nutrients – need to keep plant roots in the water – not into the module base
- Latest published data is from Bribie Island – partnership with Moreton Regional Council
    - 544 lots residential development
    - All water goes through system
    - Commenced in 2014
- University of Sunshine Coast Monitoring Results of 9 flow weighted events:
    - Total Suspended Solids (TSS) 74%
    - Nitrogen 40%
    - Phosphorus 59%
- Dealing with floods – anchor system – variable velocities and hydraulic grades – disadvantage is that you must always have water (unlike natural wetlands)
- Coping with the dry season – must always have water – detention basins ideal environment
- Serious turtle netting to keep them out as they eat plant roots! Steel coated nets have proven effective in keeping turtles out. Note – turtle netting is only necessary for wastewater projects, is not required for stormwater projects.
- Bird netting to keep out water hens when the plants are young – for the first 6 to 8 weeks
- Based on peer reviewed and published field research conducted by the Universities of Sunshine Coast and Auckland, 2,000m2 (approximately 278,000 500ml recycled PET bottles) of the SPEL FTW removes approximately:
    - 732 tonnes of fine and course sediments per year
    - 1,142kg of phosphorus per year
    - 8.6 tonnes of nitrogen per year.

Michael Linde

Port of Brisbane Pty Ltd – ***Offsite Stormwater Treatment Pilot***

Stormwater Management:

- Flood impact - Increase PBPL costs of dredging by $25M
- Better return on investment through other strategies
- Moreton Bay is going from a sandy to muddy environment over the past 40 years
- Where is the sediment coming from? – 80% of the sediment ending up in Moreton Bay comes from 20% of the Lockyer Valley; Laidley creek – sediment erosion of banks
- Temporary storage of stormwater on Whimbrel and Sandpiper Streets at
- QUT Study showed that the PBPL land is generally benign in terms of sediment, nutrients and pollution into Moreton Bay.

Offsite stormwater treatment pilot:

- Partnership between - Alluvium, SEQ Catchments, EHP, Dept Science, DIPSI, Healthy Waterways
- About 4,000 trees have been planted
- Wanted good governance and transparency – science committee to oversee the project
- Outcomes have been modelled:
    - Scientific steering committee
    - Modelling demonstrated erosion avoided – Compete – 3,780 tonnes/year
    - By way of comparison – 20 ha onsite treatment 80% - 23 tonnes/year
    - Modelling and literature review to demonstrate connection between Laidley and Brisbane River (WBM) – 186 tonnes reduction of sediment loss within 6 months

    - Sampling along Brisbane River and geochemical and isotope testing (ARI)
- Much better results for less money
- Science with the Australian Rivers Institute – sediment fingerprinting, EHP will look at the outcomes of the project
- Future – new management model (slide)
- Move away from bio-remediation - For low risk sites

Sandra Avendano
Department of Environment and Heritage Protection – *Erosion and Sediment Control Program and flexible options for nutrient management (point source)*

Erosion and sediment control and urban stormwater program
- Urban Stormwater
    - *State Planning Policy 2014* (SSP) – Flexible and locally appropriate solutions for urban stormwater management
    - Water Quality is one of the 16 State Interests which makes up the SPP
    - DEHP is working to provide guidance on flexible stormwater management which includes onsite, offsite, mix of both, including the Living Waterways framework
    - Case studies such as Port of Brisbane's Pilot Project in Laidley Creek are used to guide policy outcomes
- Erosion and sediment control (construction sites)
    - "Community of Practice" – capacity building of industry through on-site field days
    - Capacity building also involves the development of ESC Online Tool Kit:
        - DEHP Draft Compliance Procedural Guidelines available on the DEHP website
        - ESC Checklist for House Sites available on the Healthy Waterways and Catchments website
    - Technical material on management practices (e.g. High efficient Sediment Basins) to ensure improvements in the building industry on-site ESC practices.

Policy – *Flexible options for managing point source water emissions: A voluntary market-based mechanism for nutrient management (2014)*
- Nutrient management offsets – only applies to point source nutrients – nitrogen and phosphorus. Offsets do not apply to diffuse sources such as stormwater.
- Seeking to have the same water quality outcomes within the same catchment/sub-catchment
- Possible actions for managing point source water emissions:
    - "Bubble Licence" or agreement between two point sources
    - Reduction via diffuse source actions such as Riparian restoration, constructed wetlands, WSUD, fertiliser application and land management (e.g. grazing) – none of these are in SEQ, but are in the making
- Case studies such as QUU's Beaudesert pilot project provide the science behind future policy changes
- To access the policy visit http://www.ehp.qld.gov.au/water/monitoring/documents/market-based-nutrient-managment-pilot.pdf

Cameron Jackson
Queensland Urban Utilities – *Embracing Environmental Leadership*

- Sustainability and maturity
- OECD – Towards Green Growth 2011

Nitrogen Case Study:
- Nitrogen – too much is no good
- Earth's Planetary Boundaries
    - Already exceeded the planetary boundary for nitrogen

  - Do we keep investing in nitrogen based on this information?
  - Biodiversity disappearing at an alarming rate
- Are we concentrating on the right thing? – locally we need to focus on nitrogen, phosphorus and biodiversity; do we keep investing in Nitrogen reduction based on this information?
- QUU manages 11 Sewage Treatment Plants (STPs)
- Bremer River – contributes high nitrogen
- Lower Brisbane – QUU contributes about 50% of the total nitrogen
- Outside of Brisbane area QUU low source of nitrogen
- SEQ leads the way in nutrient abatement – best practice
- 2013 – business as usual – no change
- **n-print.org website to determine your individual input of nitrogen**
- $700M total spend by QUU has provided positive outcomes in terms of nitrogen reduction
- $700M spend by Unitywater
- People = 4-5kg of nitrogen per year each + 1 million extra people coming in = +400 tonne increase per year

Questions for environmental leadership:
1) Is QUU pushing the Moreton Bay ecosystem to the brink of its 'Planetary Boundary'
2) Is a 60% contribution of reactive nitrogen to the Lower Brisbane River too high?

Phosphorus Case Study:
- Actions to reducing phosphorous levels to be based on science and are also acceptable to the community
- Fighting the population growth of sewage treatment
- QUU has changed from a compliance focus to strategic planning focus to improve our environmental performance
- This year QUU is developing an environmental roadmap for improvement – nutrients and toxicity
- Develop a catchment-based contribution model for nutrients and pathogens
- Struvite treatment of Phosphorus
- Beaudesert offset project
- Urban sponge – green infrastructure sewage network
- STP "Bubble Licence" – QUU currently negotiating with EHP for the Lower Brisbane River – QUU still want to invest the money but are aiming for better environmental outcomes
- Urban Sponge – integrate solutions to soak water up before it goes to creeks
- QUU – meet with developers every quarter (projecting population growth, service delivery)

Questions

Where did the term "Urban Sponge" come from?

A term starting to be used by the Stormwater Management industry. Changing the culture of fast flowing/ hard surfaced creeks being required for flood mitigation - but instead to slow down the flow and system.

The questions of "An acceptable level of nitrogen and phosphorus" is a very difficult question to answer. Do you want us to answer this at this workshop?

Yes, I would like it to be discussed. If the science isn't good enough then do we follow greenhouse gas emissions practice. Do we break up into short term and aspirational targets/goals?

Planning involved in QUU?

QUU has master plans and are reviewed every 5 years. We look at population growth and development – projections over the next 5 years and plan the infrastructure to service the customers. A lot of money is invested in this process.

This is also done in the new developments as well as inner city.

Andrew Olds
University of Sunshine Coast – ***Marine Reserves and Estuarine Health and Resilience***

Marine Conservation

- Marine spatial planning has a range of conservation objectives:
  - Limit species & habitat loss
  - Maintain biodiversity
  - Promote ecosystem services
  - Enhance resilience (Estes et. al. 2011).
- Study of mangrove reefs and coral reef proximity in Marine Reserves – need the connectivity to have a positive impact on the biodiversity. More recruiting – leads to increased resilience of marine reserves
- Composition of corals changes – numbers of herbivorous fish
- 20-30% of Moreton Bay ecosystems should be Green Zones
- 2014 published studies showed that having coral reefs situated in Marine Reserves have improved resilience after a significant event such as flood, compared with coral reefs in fishing areas.

New work on fish in SEQ estuaries:

- Surveyed fish across 22 estuaries to look at what fish live in different estuaries and what
- University of Sunshine Coast – Fish Ecology Research You Tube Videos can be found here

Jock Mackenzie
MangroveWatch – ***Impacts on nutrient loads on tidal wetlands of the Burnett Mary and how these impacts relate to mangrove conditions around Moreton Bay***
Solomon Island study

- Effects of climate change – erosion
- Mangroves are dying - Using mangroves as a toilet is not working!

Mangroves dying across many regions.

Tingalpa Creek study

- Increase in mangrove habitat at the cost of saltmarsh wetlands
- Mangroves as water quality buffers.

Features of tidal wetlands with high water quality improvement value

- Mangroves – veg cover and density, Condition/Productivity, sediment surface – microbial communities, location (proximity to point and diffuse sources)
- Salt marsh – veg cover, healthy algal mat, high connectivity.

Mangroves as nutrient receivers

- Boggy Creek - tallest mangroves in SEQ – high growth, high biomass but low resilience
- Nutrients reduces the growth of tree roots, making mangroves more susceptible to wind, waves and floods
- High nutrients = low resilience
- High nutrients = Reduce resistance to moth impact
- Nutrient levels influence estuary mangrove biodiversity. High nutrients = low biodiversity
- Not what happens in the flood event, it is how we manage it afterwards? Encourage them to grow back rather than chopping them down.

MangroveWatch

- 300km of monitoring
- Bulimba Creek in a state of decline - mangrove death/dieback, bank slumping, low resilience.

Mangrove Gardens

- Use mangroves to address erosion and have the nutrient reduction capacity
- Fisheries production value, wildlife habitat, carbon.

Ecosystem Service Based Mangrove Management.

Jennifer Loder

Reef Check Australia – ***Reef health monitoring and reef habitat mapping in Moreton Bay***

- Reef Check Australia carries out projects incorporating art, science and conservation
- A trifecta approach is used towards programs – Research/Education/conservation, however the programs go beyond this and incorporate community-based data collection, communication and application
- There are reefs in Moreton Bay which exist in a marginal environment – extremes of the places where coral reefs are comfortable
- Moreton Bay's reefs are located adjacent to one of Australia's fastest growing cities, with a current population of two million. Conditions in the bay have been classified as "modified" or "extensively modified," with sediment and nutrients being the major pollutants of concern (Gibbes et al 2014). Several rivers flow into the bay, and over 30 major sewage plants and industrial wastewater treatment plants discharge directly into the bay (Gibbes et al 2014). The majority of sediment inputs (suspended silts and clays) into the bay are released through episodic flows caused by high rainfall events. This results in western and southern areas having the highest sediment content, highest nutrient availability, and lowest water clarity (Fellegara et al 2013).
- It is probably fitting that this talk is last, as reefs are one of the final resting places of those sediment and nutrient impacts originating from the catchments
- Reef Check Australia has trained hundreds of volunteers in the globally standardized Reef Check methods to develop both knowledge and skills
- Data is stored in online Reef Health Database (publically accessible), summary data available online, all data free to access by signing data use agreement
- Coral Reef monitoring of Moreton Bay has been occurring annually since 2007
- Coral Reefs are sensitive indicators of water quality
    - Coral bleaching
    - Coral disease
    - Rubbish
- The 2004 Moreton Bay coral reef maps (source: Queensland Environmental Protection Agency) form a key component of natural resource management decisions for the area. In 2015, a collaborative project to re-map key coral habitat areas was undertaken by Reef Check Australia, The University of Queensland Remote Sensing Research Centre and Healthy Waterways (Queensland Environmental Protection Agency in 2004). The 2015 project engaged trained volunteers to collect benthic habitat field data that allowed for review and revision of the 2004 coral spatial extent baseline.
- More recent reef surveys allowed for a more refined delineating of boundaries. Seeking better resolution imagery to allow for a repeat of boundaries and potential undertake a more direct comparison
- Priorities
    - Identify monitoring gaps (spatial, temporal, data type) that could be addressed through citizen science
    - Identify key messages to the community – what is their role?
- We acknowledge that in 2013, with a maximum of 7 years of monitoring on a few long term sites and many sites with 4 to 5 years of data, our baseline information is just starting to paint a picture of composition and change on these habitats. We look forward to many more years of volunteer monitoring and collaborative activities in the region to further build the collective knowledge and conservation of SEQ's rocky reefs.

Questions

Should Catchment Groups be protecting and restoring the mangrove buffer?
Jock - Generally best practice to undertake this work.

Historic structure of the Brisbane River in terms of mangroves?
Jock - Look at the river in the context of today, rather than keep looking back at what it was. Mangroves serve an ecosystem function
Andrew - Upstream mangroves can serve as a significant impact to the water quality of the Bay.

Should there be more Green Zones in the bay? Would you lobby for this?
Andrew – As a general rule we should conserve 20-30% of any ecosystem
Not all green zones are equal
More bang for buck in the right places – more scientific and widespread approach to the location of Green Zones
If a site does not work, then we need to change the location of the Green Zone to optimise environmental outcomes

Should we be putting in more artificial reefs?
Andrew - It depends on what you want. The key question is - do artificial reefs supplement fish or are they just taking them from somewhere else? Is the structure useful for the species you want to increase the numbers?