Cultural Drivers towards Land Based Discharge and Applications Enabling this

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18 September 2019

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Agenda

- Cultural Drivers Towards Land Based Disposal
- Legislative Drivers Towards Collaboration
- Kaitiakitanga
- Tapu to Noa
- Land Based Treatment and Disposal
- Case Studies

Cultural Driver towards Land Based Disposal

- Maori oppose discharge to water
- Tapu to Noa
- Papatuanuku can restore the Mauri of water

Concept for Rotorua Lakes Council WWTP upgrade

https://letstalk.rotorualakescouncil.nz/rotorua-wastewater-treatment-plant?tool=news_feed

The Importance of a Collaborative Relationship

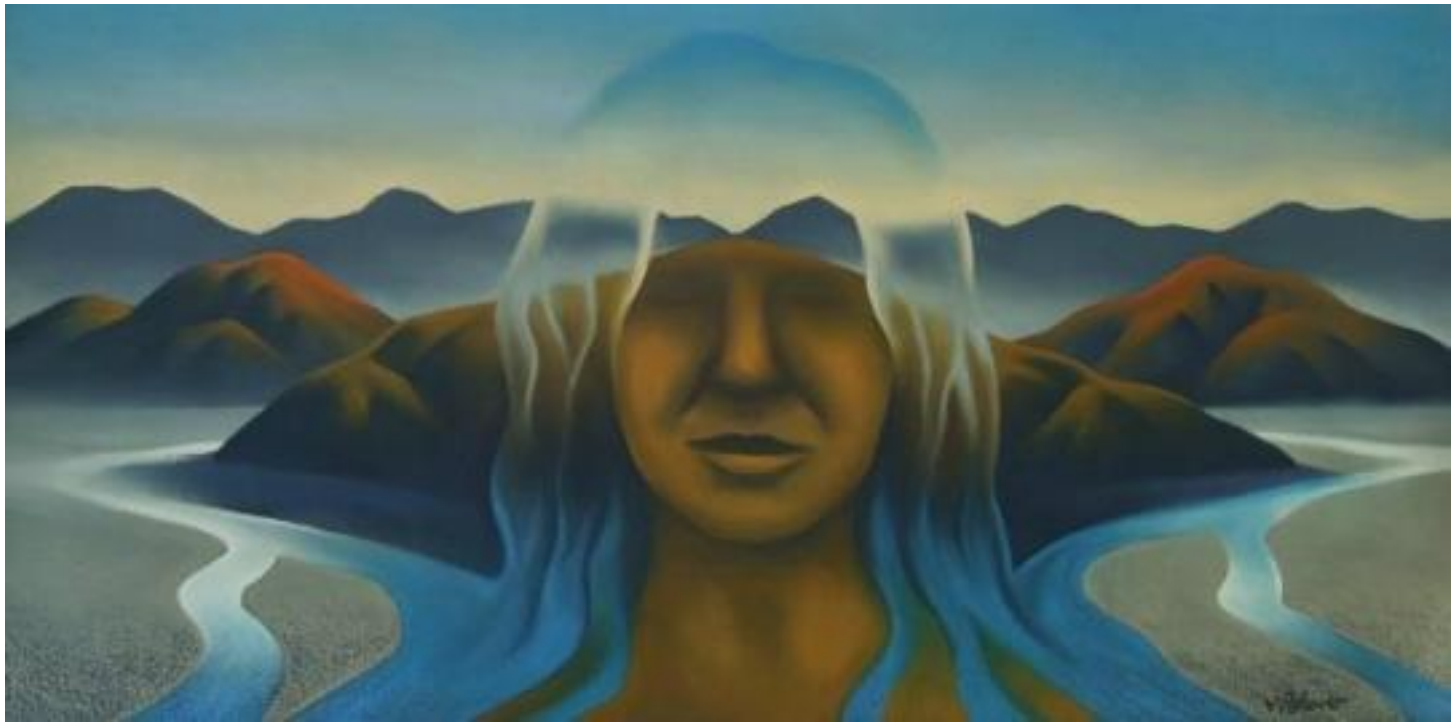
- Treaty of Waitangi - the three “P’s”
  - **Partnership**
  - **Protection**
  - **Participation**
- Experience has shown benefit in early iwi / hapu participation in a partnership approach

Legislative Drivers

- 3 key pieces of NZ legislation
  - Environment Act 1986
  - Resource Management Act 1991
  - Local Government Act 2002
- Led to development of collaborative approaches in developing resource consents, consent conditions and technology solutions.

Kaitiakitanga

- Kaitiaki: Māori term – concept of guardianship
- Tangata whenua have a protection role to the environment
- Cultural objection to discharge of human wastewater to water
- Tangata whenua view holistically – do not focus on treatment methods



From Tapu to Noa

- Key cultural concepts that inform present Māori thinking
- Humans possess tapu which extends to body parts and waste
- Tapu and noa are not fixed and can change through time
  - i.e. latrine sites, over time, becoming sites for productive gardens.

From Tapu to Noa

- Papatūānuku and Ranginui – established relationships convert chemicals from tapu to noa
- Scientifically these are bio- and physico-chemical transformation of chemical compounds
- Māori view biowastes as something that should be responsibly managed
- Disposal schemes include a final land contact stage

Treatment Options

- Treatment options available which match treatment to discharge pathway
  - Soil contact
  - Irrigation / wetlands with surface flow discharge
  - Irrigation / Infiltration wetlands with no surface flow discharge
  - Evapotranspiration

Treatment Options

1. Soil Contact
   - Restoration land contact bed or flow through wetland
   - Tapu to Noa
   - Small footprint
   - Low cost
   - Short detention time

Treatment Options

2. Irrigation / wetlands with surface flow discharge
   - –High rate irrigation year-round
   - –Wetlands with large shallow vegetation zones and no liner
     - Small Footprint
     - Short detention time
     - Low cost
     - Significant water quality improvement

Effluent Irrigation on Wet Meadow

Treatment Options

3. Irrigation / Infiltration wetlands
   - –Surface or subsurface year-round irrigation
   - –Wetlands with emergent vegetation and no liner
     - Size depends on soil properties
     - High cost
     - Significant water quality improvement

Wakodahatchee Groundwater Recharge Wetlands

Treatment Options

4. Evapotranspiration

- Low rate irrigation or lined wetland
  - –Largest footprint
  - –May require storage
  - –Highest cost
  - –Highest level of treatment

Year-round irrigation with automated linear move machine

Case Study – Roseburg Urban Sanitary Authority – Oregon

- Natural treatment system
- High rate irrigation
- Surface flow discharge
- Soil and aquifer treatment with percolation to groundwater
- P, N, Temp, and Cl_2 discharge limits require additional treatment
- Extensive soil and groundwater investigations and modelling
- Soil column P retention study

Roseburg Urban Sanitary Authority – Oregon

- 30 MLD capacity
- 25 megalitre storage pond
- 0.8 ha constructed wetlands
- 80 ha drip and microspray irrigation
- 38 ha historic natural wetlands restored
- Wetlands polish surface discharge

Effluent is Irrigated from the ridgeline to the valley bottom

Roseburg Urban Sanitary Authority – Oregon

- 30% groundwater discharge and 70% surface water discharge
- Average detention time ~6 months

Case Study – Belfair / Lower Hood Canal WRF

- Hood Canal and Salish Sea are sensitive spawning habitat
- Native American tribal restrictions
  - No surface water discharge permitted
- Decommissioned septic systems, new sewage collection system, advanced treatment water reclamation facility
- 190 ML storage pond
- Year-round irrigation

Belfair / Lower Hood Canal WRF

- Reuse – enhances timber production
- No surface discharge
- Aquifer / Groundwater recharge
- 1 week detention time

Case Study – Woodburn Farmed Forest, Oregon

- Poplar Tree Soil Treatment for Effluent and Liquid Biosolids
- WWTP could not meet effluent ammonia loading limits
- Site has successfully operated since 1999
- Reuse of up to 4 MLD of effluent for irrigation in July and August
- Public education program to build community acceptance and pride

Woodburn Farmed Forest, Oregon

- Micro-spray application
- Hard hose reel liquid biosolids application
- Automated control
- Wood fibre crop sold to paper mill
- No surface discharge in summer
- 3 month average water detention time

Phytoremediation and Hydraulic Control of Groundwater Plume in Southern California

- Regain hydraulic control of groundwater plume containing hexavalent chromium [Cr (VI)]
- Extraction of groundwater and discharge of extracted water through subsurface drip and low energy surface irrigation
- The irrigated fields treat chromium to water quality standards
- Flows up to 6000 litres per minute irrigated year-round on 120 ha
- Groundwater pumping can allow recycle for additional treatment

Phytoremediation and Hydraulic Control of Groundwater Plume in Southern California

- Crops are a mixture of warm and cool season grasses allowing daily irrigation year round
- During winter, evapotranspiration is low, irrigated water percolates to groundwater after soil treatment
- In summer all water is transpired

Phytoremediation and Hydraulic Control of Groundwater Plume in Southern California

- Crops removed ~120 tons of nitrate nitrogen over 9 yrs
- Evapotranspiration with no surface water discharge and 25% groundwater discharge
- Average detention time ~6 years before reaching groundwater

Groundwater Recharge Wetlands with no Surface Discharge

QUESTIONS?

September 18, 2019

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