# RLC Technical and Environmental Investigation Tasks Update to RPSC 20th May 2015

**1. TERAX and Wastewater Treatment Project Interaction**
- RPSC Workshop held
- Assessment nearing completion. Draft Mott MacDonald Report received by RLC

**2. WWTP Treated Wastewater Direct Discharge Options**
- RPSC Workshop held
- CAS & RPSC initial input sought
- To be integrated to output of Effects Study (Item 5 below) Output - 29th May 2015 (see below)

**3. Alternative Land Treatment Investigation**
- Mott MacDonald working with RLC. Draft Report received
- Final Report due 19th June 2015 for RPSC 23rd June 2015

**4. WWTP Strategy Study**
- Task being undertaken by Mott MacDonald - Consultants
- Focussed on "Best Overall Approach" to WWTP upgrading
- Includes TAG/Mott MacDonald short-listed Treatment Options 1, 2 & 3 and decommissioning primary treatment to obtain carbon source, full conversion to MBR Plant, options with and without TERAX
- Draft Report received. Interaction includes Item 1 - TERAX

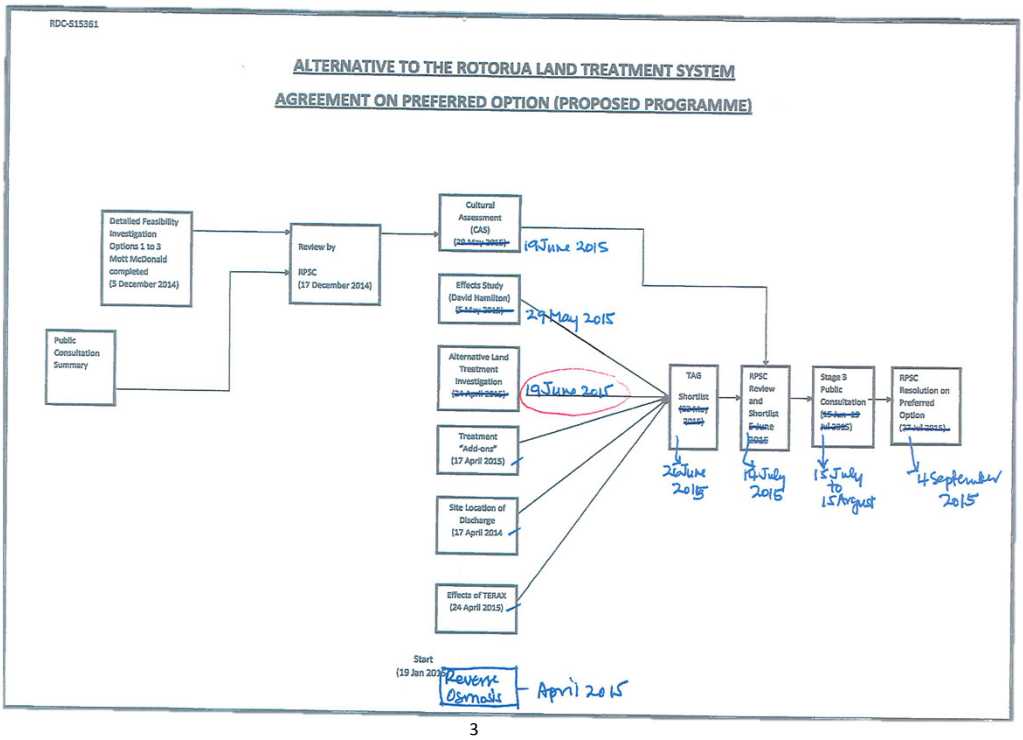


# RLC Technical and Environmental Investigation Tasks Update cont...

**5. Environmental Effects Study of Treated Wastewater Discharge**
- This major task well in progress - 26 1D models and 11 3D models
- Being undertaken by University of Waikato led by Professor David Hamilton
- Interacting with TAG activities and RLC direct discharge location task
- Draft Report due 29th May 2015

**6. Reverse Osmosis etc Treatment Considerations**
- General information presented RPSC 19th March 2015 and 20th May 2015
- Further direction sought from RPSC how much further to take Reverse Osmosis
- Ultrafiltration is Option 2C in Mott MacDonald Dec 2014 Report (covered later today)
- Activated Carbon process currently being investigated

**7. Treatment Add-on's Update**
- RLC/TAG update to RPSC 22nd April 2015
- No updates

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## GROUP B: QUESTIONS & ANSWERS

Further information to that presented to RPSC on 22 April 205

**Question 1 Effects of Wastewater Treatment of Health compounds in sewage**

- Question related to US Department of Health Household Products List
- Professor David Hamilton has information from the Brisbane Reclaimed Water project he was involved in. Will present to RPSC in June
- Will "try to match" some typical compounds listed to the work on micro-pollutants and removal in WWTP's of the Rotorua type

**Question 2 Reverse Osmosis (RO) Indicative Costs**

- Refer RO information previously presented including the very indicative $A90M capital cost for Rotorua size
- Last RPSC agreed to further look at Activated Carbon and Ultrafiltration (UF)
- UF is the step before Reverse Osmosis (RO) to produce reclaimed/drinking water quality
- UF membranes next slides and membrane particle size
- Additional work on Reverse Osmosis??

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## GROUP B: QUESTIONS & ANSWERS

Further information to RPSC on 22 April 205

**Option 2C Ultrafiltration (UF) Membranes**

- The Mott MacDonald December 2014 Report included it as Option 2C of Filtration Options
- Option 2C which includes the Option1 Base Case has an indicative Capital Cost of $22.3M and annual operating addition of $0.47M
- Of this the actual UF capital cost is $7.9M and additional annual operating is $180,000pa
- Membrane nominal pore size 0.02 microns
- Refer to slide for removals

**Question 3 Reverse Osmosis (RO) Systems – What happens to the Waste Concentrate Scheme?**

- Typically 15-25% of the incoming treated wastewater flow to the RO plant
- This waste stream is salty and can be difficult to handle/dispose of
- At coastal locations and desalination plants usually returned to the sea
- Inland plants discharge to freshwater, to land, bore injected into land, or evaporated to leave a salt
- Would be a significant issue in the Rotorua inland situation and taking into account the driver(s) for RO



Ultrafiltration (UF) equipment and Pore Sizes and Correction of earlier incorrect figure showing existing MRB at 4 Micron Pore Size

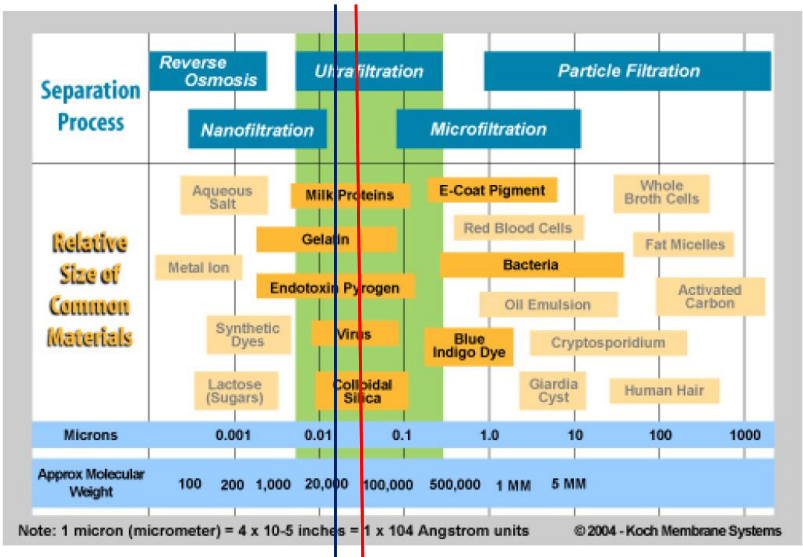


Figure 1.0 Relative Particle Sizes (Koch, 2004)

Existing MBR 0.04 Micron Pore Size (Zeeweed 500D module)

Option 2C Mott MacDonald Dec Report – Membrane Ultrafiltration (UF) Z-PAK UF System – 0.02 Micron Pore Size

## The Option 2C – Ultrafiltration (UF) Option

GE Power & Water
Water & Process Technologies

# Z-PAK Pressurized UF Systems

**ZeeWeed* 1500 Ultrafiltration for 400 to 4000 gpm (6 MGD)**

### Benefits

- The ZeeWeed 1500 membrane has a 0.02 µm nominal pore diameter - for optimal removal of particulates, bacteria and viruses. Its PVDF chemistry gives mechanical strength and chemical resistance.

| Membrane Properties | |
|---|---|
| Material | PVDF |
| Nominal Pore Size | 0.04 micron |
| Surface Properties | Non-Ionic & Hydrophilic |
| Fiber Diameter | 1.9 mm OD / 0.8 mm ID |
| Flow Path | Outside-In |

### Typical Permeate Quality

| | |
|---|---|
| Recovery Range (single stage) | 90-95% |
| Bacteria, *Giardia, Cryptosporidium* | ≥4-log removal |
| Iron | ≤0.05mg/L[¥] |
| Manganese | ≤0.02 mg/L[¥] |
| TSS | ≤0.1 mg/L |
| TOC | 50-90% removal[¥0] |
| Arsenic | <5µg/L[¥] |
| Color | <5PCU[¥0] |

[¥] Pretreatment required
[0] dependent on water quality

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## Rotorua WWTP – MBR (Membrane Bioreactor) Plant which takes one third of the daily flow

GE Power & Water
Water & Process Technologies

# ZeeWeed* 500D Module

**Immersed Hollow-Fiber Ultrafiltration Technology**

| Membrane Properties | |
|---|---|
| Material | PVDF |
| Nominal Pore Size | 0.04 micron |
| Surface Properties | Non-Ionic & Hydrophilic |
| Fiber Diameter | 1.9 mm OD / 0.8 mm ID |
| Flow Path | Outside-In |

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## GROUP B: QUESTIONS & ANSWERS cont...

**Question 4 Water quality of unpolluted springs and lake water for comparison with treated wastewater and treated wastewater once discharged**

- Regional Council has good information on key parameters that are being used in the Effects Assessment
- This information will be included as part of the Effects Assessment so that comparisons with previous and current water quality and ecology can be made to the discharge assessment
- Will include as far as possible the key parameters that CAS has identified

**Question 5 Further information on Black Mica as an "Add-On"**

- Refer RPSC 19th March 2015 information Slide 2 and "Add-On's" update RPSC 22nd April 2015
- No new full scale "case history" had been obtained to date – still awaited

**Question 6 Status of Various "Add-On's"**

- Updated RPSC 22nd April 2015
- No new updates. Activated Carbon being covered elsewhere



## GROUP B: QUESTIONS & ANSWERS cont...

**Question 7 Information on TERAX**

- RPSC Workshop 22nd April 2015
- Draft Report from Mott MacDonald received and being reviewed RCC and TAG

**Question 8 Information on Treated Wastewater Discharge Options and Other Locations**

- RPSC Workshop 22nd April 2015 – initial information
- Initial feedback from CAS and RPSC Committee sought
- Effects Study looking at a range of Lake Rotorua shoreline (as per initial information) and lake bed discharge locations and Puarenga Stream locations

**Question 9 Option to Totally Use MBR for the Full Plant (100% MBR's)**

- Included in the Mott MacDonald WWTP Strategy Study
- Draft Report just received being reviewed by RL and TAG from Mott MacDonald

**Please note that an updated Glossary of Terms has been prepared (Issue No.3 30th March 2015) and is attached to RPSC Minutes 19th March 2015**

## TAG Core Short List Options - Adopted By RPSC

**Wastewater Inputs Management Options**

- Water conservation
- Wet weather flow and infiltration management
- Trade-waste management and pre-treatment
- New Infrastructure types and standards

Note:
Also refer TAG "Add-on's" further being considered. This includes the technically feasible 'Best for Lake' option and TAG's request to RPSC about the cultural considerations relating to it.

Core Treatment Options (Based on Rotorua WWTP)

| Option 1 Base Upgrade | Option 2 Base Upgrade + Filtration | Option 3 Base Upgrade + Nitrate Removal | Option 4 Dual Discharge | Option 5 New Land Treatment System |
|---|---|---|---|---|
| - Dissolved-Phosphorous Removal<br>- UV to kill pathogens | - Phosphorous Removal<br>- UV to kill pathogens<br>- Filtration (particulate removal) | - Phosphorous Removal<br>- UV to kill pathogens<br>- Denitrifying Process (nitrate removal) | - MBR discharge to water<br>- New Land Treatment System for Bardenpho | - Land Treatment System |

MBR

Bardenpho

Ecosystem Re-Entry (Treated Wastewater Discharge / Disposal)

**Water Discharge Options**

| Direct discharge to water | Discharge to water via ecosystem |
|---|---|
| • Open Pipe<br>• Rock passage to direct discharge | • Wetland<br>• Rapid infiltration beds<br>• Riparian / Gabions<br>• Natural monitoring Pond |

**Land Discharge**

Treated wastewater discharged to land with potential to modify soils with biochar

Wastewater Strategy which underpins the future Consent (Roadmap)



Workshop with RPSC:

# Detailed Feasibility Study

## Alternatives to Land Treatment for the Rotorua WWTP

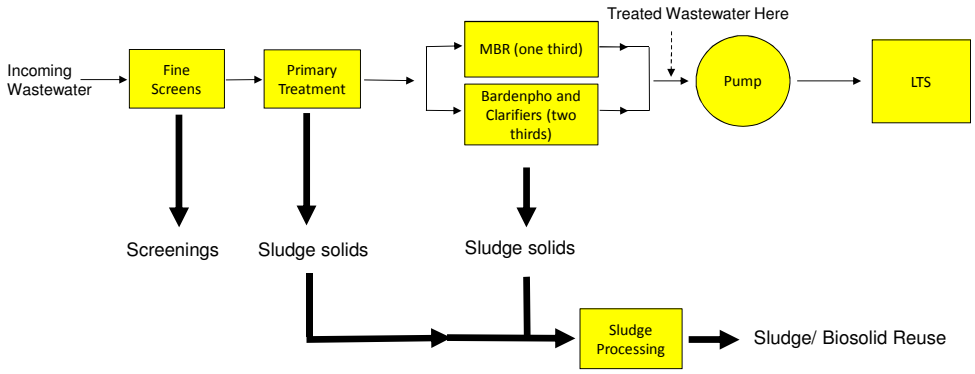
## Mott MacDonald Report December 2014

## Presented to RPSC December Meeting

How do the shortlisted options fit together?

Starting Point

**The Existing Wastewater Treatment Plant (WWTP) and Land Treatment System (LTS) Simplified**




Key: Existing Process | Base Case New Processes | Option 2 Addition to Base Case | Option 3 Addition to Base Case

## Treatment Options 1, 2 and 3

| Option | Treatment Plant | | Wastewater Ecosystem Disposal/Discharge Option |
|---|---|---|---|
| | Upgrade | Description | |
| 1 | Base Option | ▪ Flow balancing<br>▪ Phosphorus removal (chemical addition of Alum)<br>▪ UV disinfection | ❖ Pipe to direct discharge (with & without diffuser)<br>❖ Rock Passage to direct discharge |
| 2 | Base Option + Filtration | ▪ 2A Disc filters<br>▪ 2B Sand filters<br>▪ 2C Membrane filters | ❖ Wetland<br>❖ Rapid Filtration Beds<br>❖ Gabion/Riparian |
| 3 | Base Option + Denitrifying Filtration/Carbon Bed | ▪ 3A Denitrifying sand filters<br>▪ 3B Carbon beds | ❖ Natural monitoring pond |



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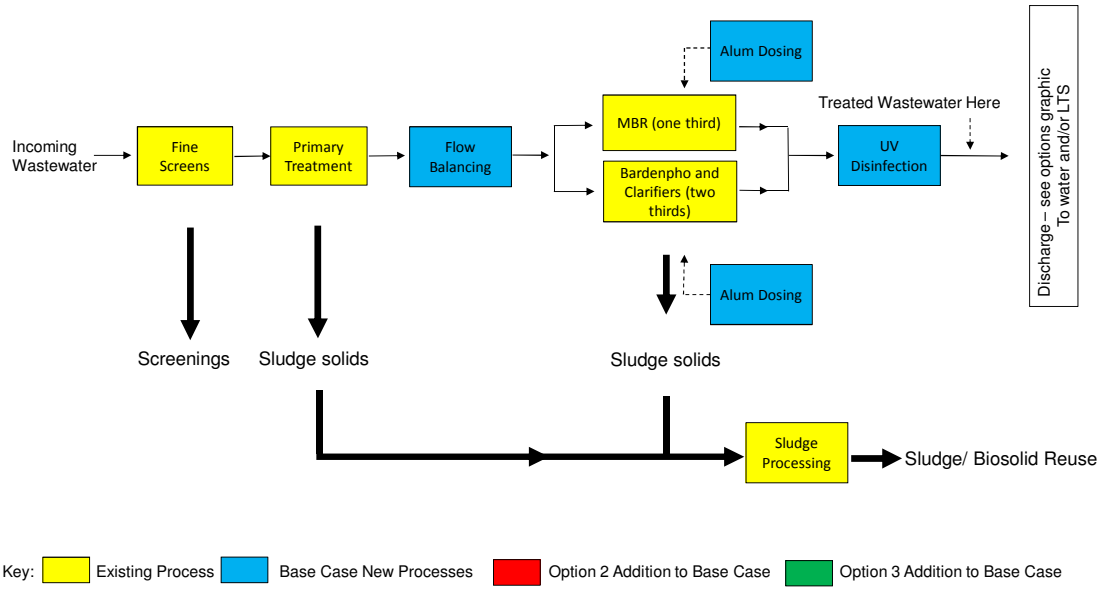
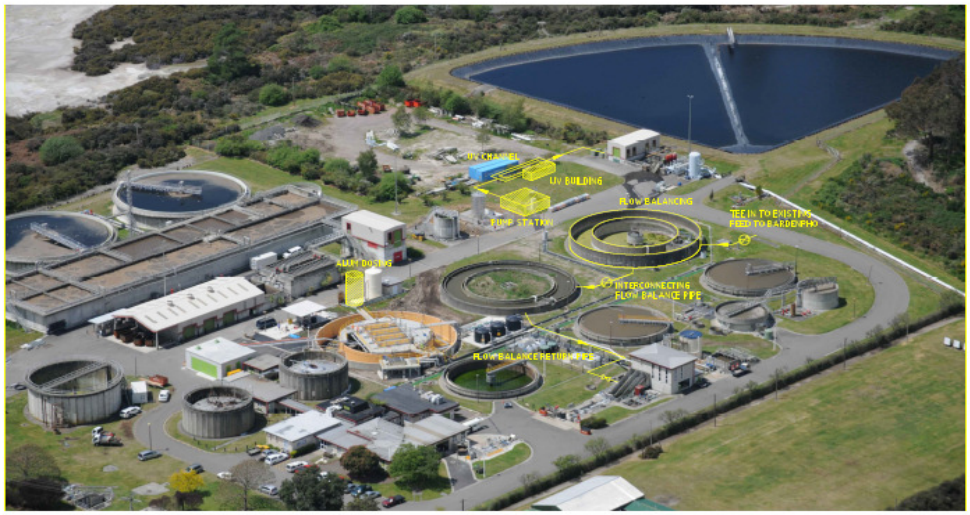
## Option 1 - The Base Case

Add in
- Flow Balancing
- Alum dosing for phosphorus removal
- UV disinfection to kill pathogens (germs)
- New discharge to water and/or LTS (refer separate graphic)




Key: Existing Process | Base Case New Processes | Option 2 Addition to Base Case | Option 3 Addition to Base Case

## Option 1 Base Case






Mott MacDonald
Level 1, 20 Union Street
PO Box 37568
Parnell 1151
Auckland
New Zealand
T +64 (0)9 355 2400
W www.mottmac.com

| Client | Rev | Date | Drawn | Description | Ckd'd | Appd |
|---|---|---|---|---|---|---|
| ROTORUA DISTRICT COUNCIL | 0 | 21.10.14 | SC | PLANT LAYOUT | | |

Title: OPTION 1 - BASELINE
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Drawing Number: SK-001
Rev: 0
Status:

## Options 2A, 2B & 2C - The Base Case and Filtration

Add in to the Base Case – Filtration – three alternatives

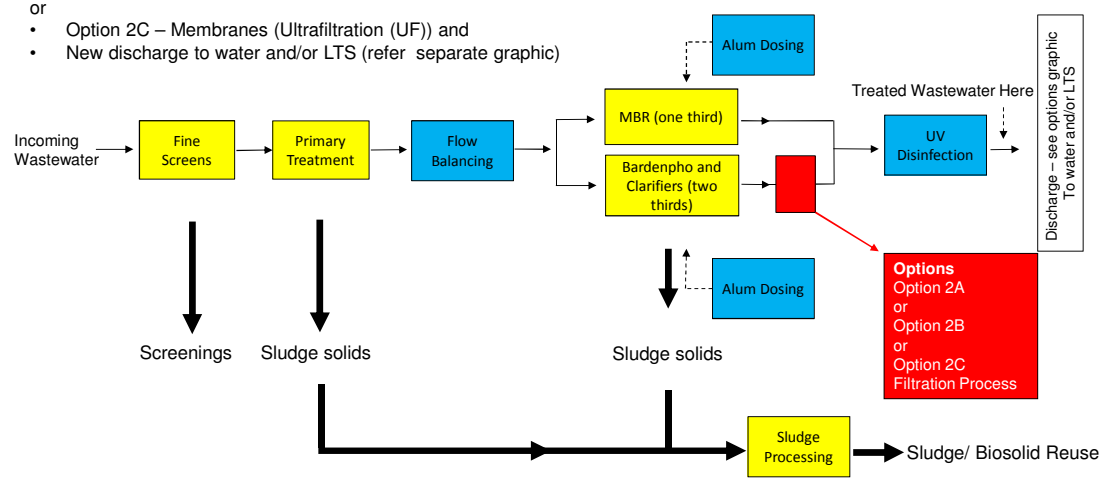
- Option 2A – Disc Filters

or

- Option 2B – Sand Filters

or

- Option 2C – Membranes (Ultrafiltration (UF)) and
- New discharge to water and/or LTS (refer separate graphic)




Key: Existing Process | Base Case New Processes | Option 2 Addition to Base Case | Option 3 Addition to Base Case

## Option 2C – Base Case Plus Membrane Filters




Mott MacDonald
Level 1, 23 Union Street
PO Box 37626
Parnell 1151
Auckland
New Zealand
T +64 (09) 375 2400
W www.mottmac.com

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Title: OPTION 1c - BASELINE AND MEMBRANE FILTER
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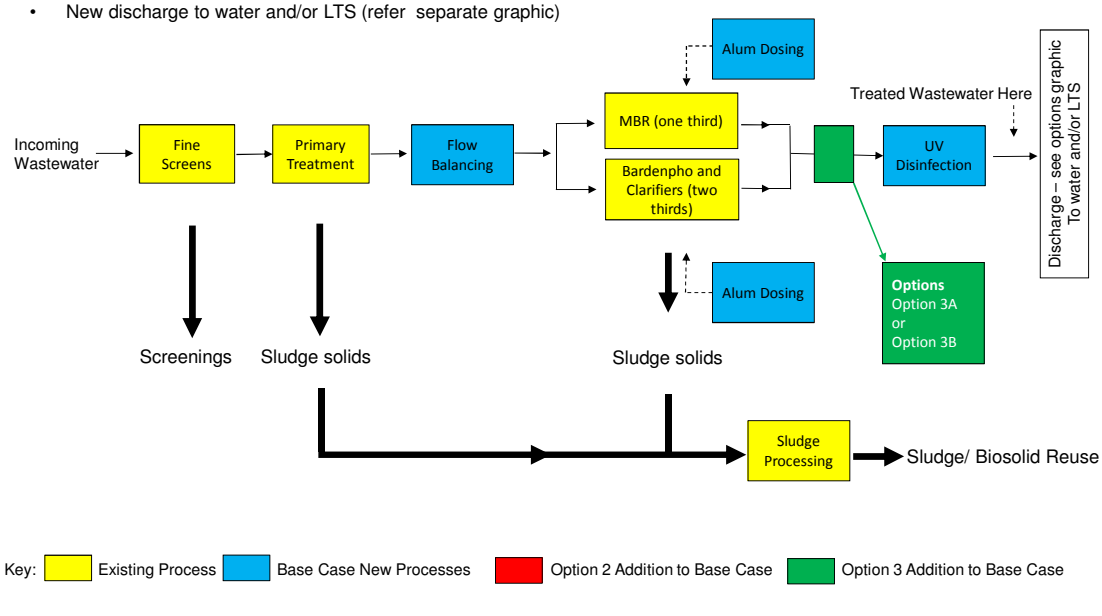
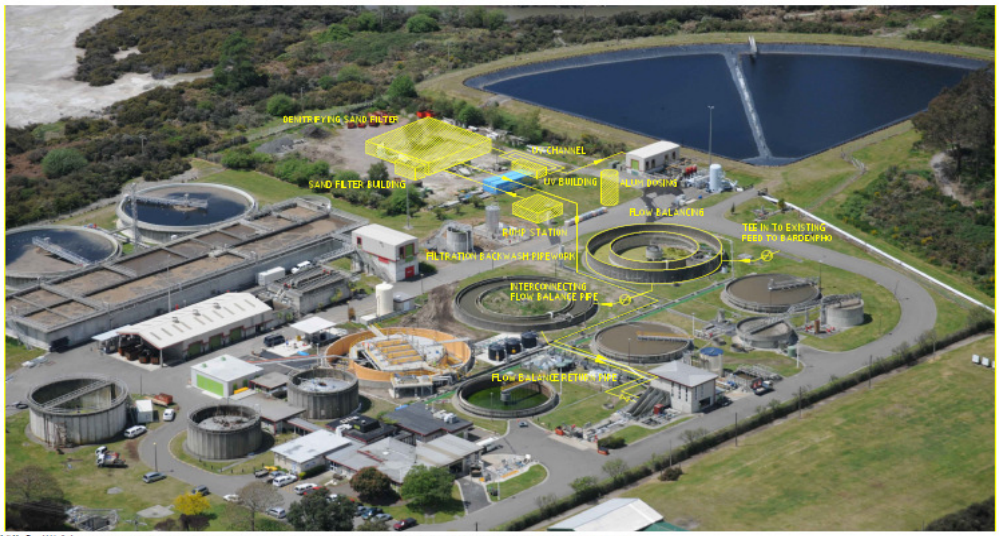
## Options 3A & 3B - The Base Case and Denitrifying Filtration / Carbon Beds

Add to the Base Case
- Option 3A – Denitrifying Filters

or
- Option 3B - Carbon Beds and
- New discharge to water and/or LTS (refer separate graphic)



## Option 3A – Base Case Plus Denitrifying Sand Filter



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| Mott MacDonald<br>Level 1, 23 Union Street<br>PO Box 37535<br>Parnell 1151<br>Auckland<br>New Zealand<br>T +64 (09) 375 2400<br>W www.mottmac.com | Client: ROTORUA DISTRICT COUNCIL | Rev | Date | Drawn | Description | Chk'd | Appr'd | Title: OPTION 2a - BASELINE AND DENITRIFYING SAND FILTERS | Drawn | |
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