Wastewater Strategy Study

Rotorua WWTP

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Scope of Works

- Identify the most appropriate treatment process for the WWTP to meet future nutrient limits of 30tN/yr and 3tP/yr.
- Study based on identifying a treatment process that will meet the proposed nutrient limits without any assumption of using TERAX or not
- Compare to other processes/ plant to validate likely performance
- CAPEX, OPEX and NPV

Project Drivers

- Ability to meet the mass discharge of 30tN/yr and 3tP/yr from the plant.
- Requires an average total N of 3.5mg/L
- Requires an average total P of 0.35mgP/L in future
- No clear bio solids drivers – max dry solids and minimum volume assumed
- No disinfection standard but a likely requirement if final effluent is discharged to surface water – needs more investigation

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Option Selection – Phosphorus Removal

- Good nitrogen removal and biological phosphorus removal can be achieved in current plant(s)
- Additional Carbon dosing is double the cost of Alum

Conclusion use chemicals to remove phosphorus

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Option Selection – Filtration

- Bardenpho has high suspended solids in effluent (ave 23mg/L)
- These solids contain N & P – about 7%N and 2%P
- If current performance is maintained then effluent TSS represents 10tN/yr and 3.65tP/yr
- Removing solids is essential if targets are to be met
- Best filtration (most solids removed) is via membrane filtration – UF or similar

Conclusion filtration of final is essential to meet future limits – membranes will give highest TSS removal (smallest effective pore size)

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Option Selection – Nitrogen Removal

- Many ways to remove nitrogen including current type of process
- Nitrogen removal efficiency of approx 93% needed to met new limits
- Can a secondary process achieve this or is a tertiary system needed
- Can the required level of N removal be achieved without tertiary treatment (other than filtration)?

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Option Selection – Nitrogen Removal

- Water Research Foundation (WERF) study “Quantifying Nutrient Removal Technology Performance”
- Takes 22 of the best performing plants in US and compares N&P removal against, plant type and configuration

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Option Selection – Nitrogen Removal

Plant	Configuration	Median TN (mg/L)	N Removal
Piscataway, MD (78,000m3/d)	Activated sludge and Tertiary Filters	3.00	86%
Eastern WRF, FL (64,000m3/d)	Bardenpho and tertiary Filters	3.64	90%
Parkway, MD (21,600m3/d)	4 Stage Bardenpho	3.40	88%
Rotorua WWTP (23,800m3/d)	?	3.50	93%

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Option Selection – Nitrogen Removal

- Secondary can meet limits proposed, however:
  - Data presented by WERF is based on median (or 50% of the time) performance
  - If higher levels of confidence are required say 90th percentile (i.e 90% of samples are less than) then tertiary process essential
- Secondary process considered suitable for limits proposed (i.e. ave or median of 3.5mgN/L)

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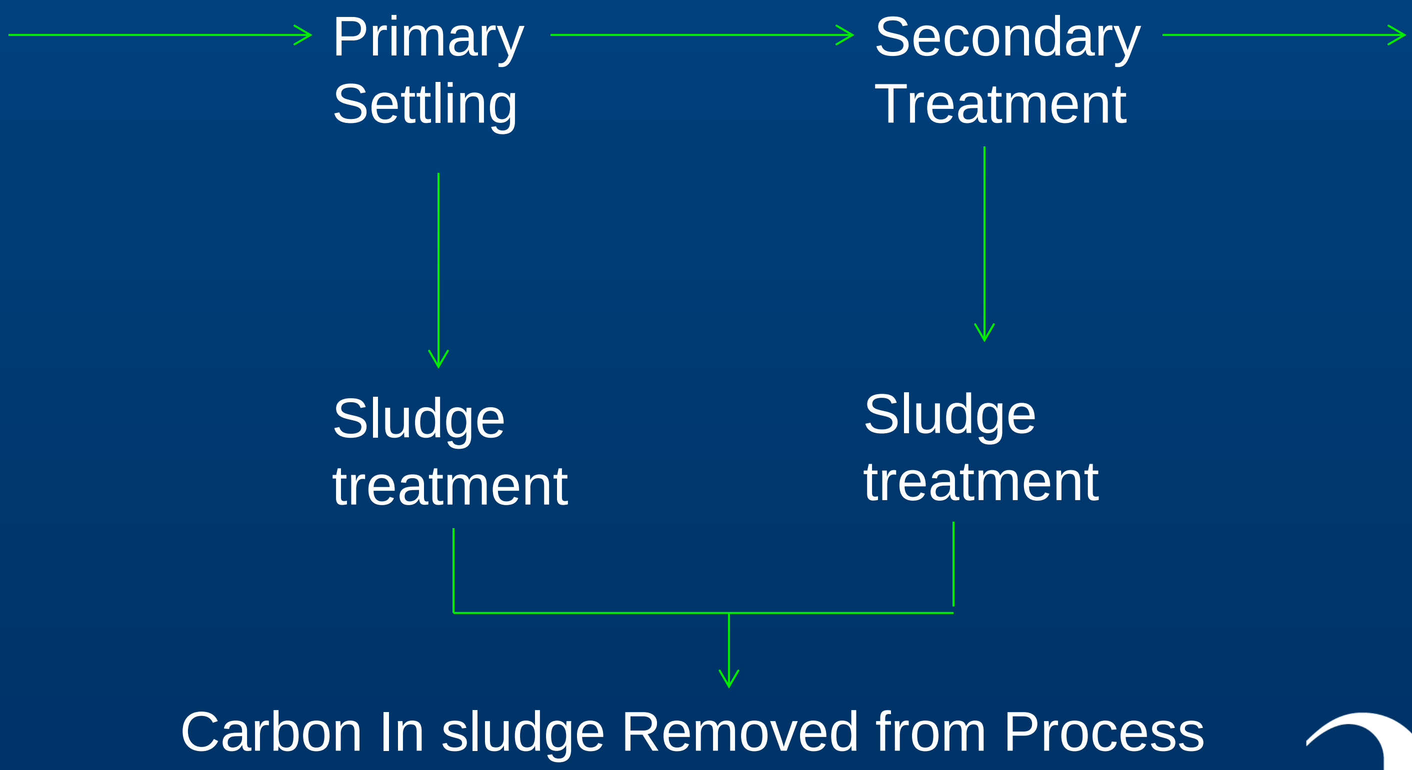
Option Selection – Carbon Balance



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Option Selection – Carbon Balance

Secondary Treatment

Sludge treatment

Carbon from primary sludge used in process

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Option Selection – Carbon Balance

- Potential to reduce ethanol use by 700L/d
- Reduce sludge production by 40%
- Consequence is that there are more solids in secondary reactor (Bardenpho)
- Unlikley that clarifiers will have sufficient capacity to handle increased flow and increased solids.

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Process Selection

- Given that:
  - Phosphorus removal is via chemical means
  - Filtration is essential
  - Single stage process can achieve standards
  - Can make better use of carbon but this would means clarifiers of Bardenpho over loaded
  - Disinfection likely to be required

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Process Selection – Full MBR

- Ideal Process is:
  - Bypass of primary tanks
  - Conversion of Bardenpho reactor to MBR and modify aeration
  - Dewater Biosolids and remove from site either as a “cake” or destroy solids via TERAX
- Standards for disinfection unknown but UF will remove bacteria

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Process Selection

- Performance of MBR (current) with respect to indicator organisms:
  - Median FC – 0FC/100mL
  - 95^{th} % ile FC – 14FC/100mL
  - Median E. coli – 0/100mL
  - 95^{th} % ile – 6/100mL

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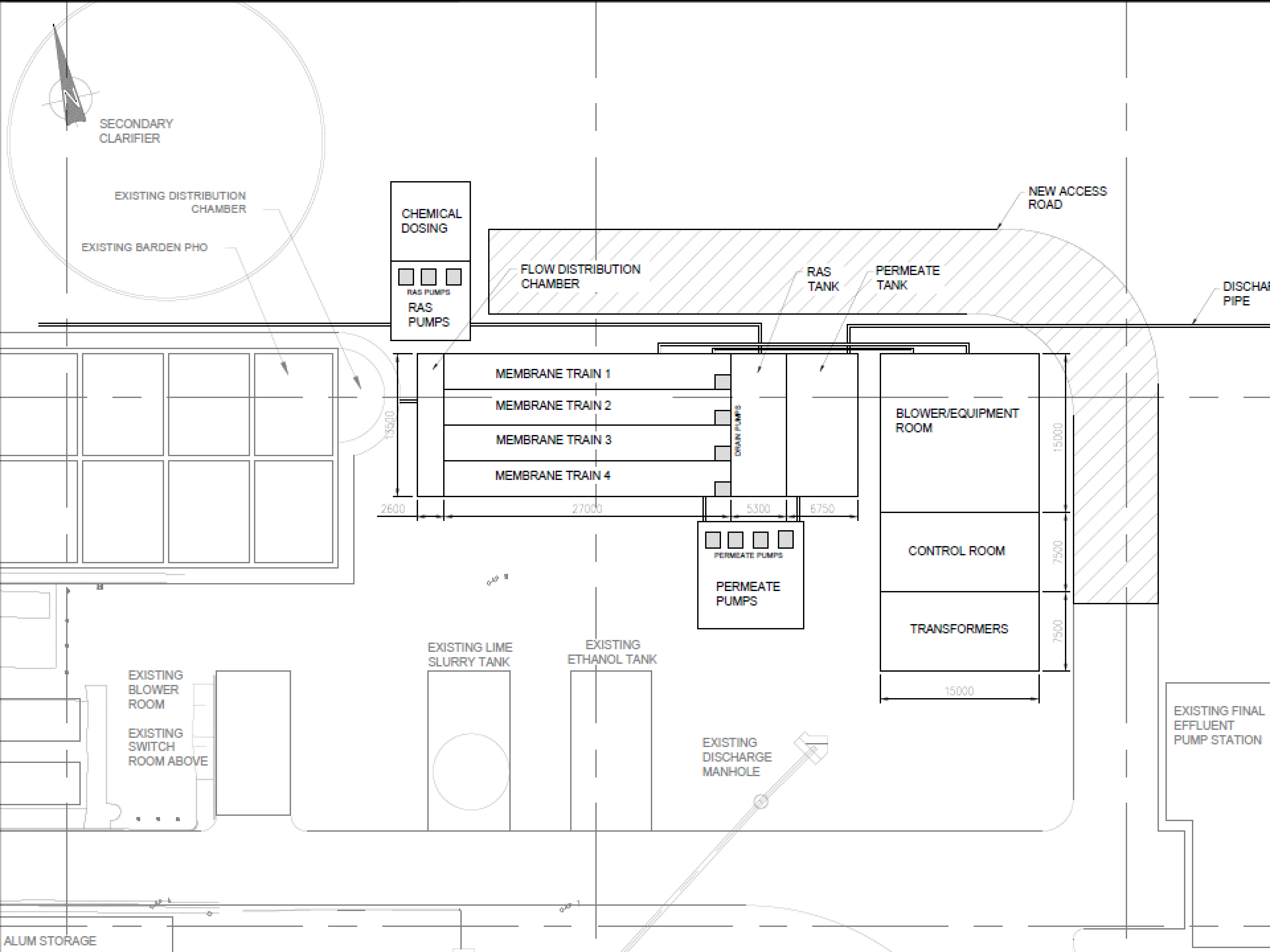
SECONDARY CLARIFIER
EXISTING DISTRIBUTION CHAMBER
EXISTING BARDEN PHO
CHEMICAL DOSING
RAS PUMPS
RAS PUMPS
NEW ACCESS ROAD
FLOW DISTRIBUTION CHAMBER
RAS TANK
PERMEATE TANK
DISCHA
PIPE
MEMBRANE TRAIN 1
MEMBRANE TRAIN 2
MEMBRANE TRAIN 3
MEMBRANE TRAIN 4
DRAIN PUMPS
13500
2600
27000
5300
6750
BLOWER/EQUIPMENT ROOM
15000
CONTROL ROOM
7500
TRANSFORMERS
7500
15000
PERMEATE PUMPS
PERMEATE PUMPS
EXISTING LIME SLURRY TANK
EXISTING ETHANOL TANK
EXISTING BLOWER ROOM
EXISTING SWITCH ROOM ABOVE
EXISTING DISCHARGE MANHOLE
EXISTING FINAL EFFLUENT PUMP STATION
ALUM STORAGE

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Costs

- CAPEX - $21 Million inclusive of dewatering and alum dosing
- CAPEX -$32.8 Million with non works costs and contingency

- Greg Manzano to present OPEX costs

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