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memorandum

TO	Tanvir Bamji	FROM	Khun Chueaphoodee & Oliver Hunt
	Watercare Services Ltd	DATE	17 May 2024
RE	Beachlands WWTP: Assessment of Overland Flow System Treatment Performance – Memorandum 3 (Interim)		

1.0 Background

Watercare Services Ltd (**Watercare**) is currently undertaking technical assessments to inform the resource consent application for the discharge of treated wastewater from the Beachlands Wastewater Treatment Plant (**WWTP**). The consent will provide for projected population growth and an increase in the capacity of the WWTP to 30,000PE over a proposed 35-year term. The Best Practicable Option (**BPO**) for the discharge was identified as the continued use and expansion of the existing Overland Flow System (**OLF**) which is used to create a diffuse discharge from the Beachlands WWTP to the Te Puru Stream.

Pattle Delamore Partners (**PDP**) previously completed a desktop assessment of the existing OLF treatment performance, outlined in PDP's memorandum *"Beachlands WWTP: Assessment of Overland Flow System Treatment Performance – Memorandum 2"* (PDP, 2024). Following the recommended outcomes from this assessment, Watercare has engaged PDP to complete a more detailed investigation into the performance of the OLF and pond at Beachlands. This investigation aims to assess the performance of the overland flow slope and the farm pond individually to determine their respective contributions to wastewater treatment post discharge from the WWTP. This assessment will help the design of any new or expanded OLF. The investigation involves site inspections, sampling of treated wastewater at various points within the overland flow and farm pond system, and measurement and analysis of water quality parameters to quantify treatment efficiency.

This memorandum has been prepared to describe the methodology used and the results of the OLF and Pond investigations undertaken between 9 April 2024 and 11 May 2024. Please note that this is an interim report, as not all laboratory results were available at the time of issue. To date, the first six of ten rounds of weekly sampling have been completed, however, laboratory results are only available for the first four sampling rounds. The conclusions and discussions herein are subject to change following PDP's receipt and analysis of additional laboratory results.

2.0 Investigations

2.1 Overland Flow System and Farm Pond Overview

PDP conducted a walk-through of the OLF area and identified, at the time of the site visit, three active dispersion zones, labelled A, B, and C. During the site visit no flow was observed from Zone D, and no readily accessible sampling points were located for Zone D. Each zone features two sets of pipes at the top. Poor dispersion of wastewater and rapid concentration or channelisation of flows were observed down the slope. A full description of the existing OLF is provided in PDP Memorandum 1 "Beachlands WWTP: Preliminary assessment of land area requirements for overland flow system expansion – Memorandum 1".

In each zone, following the channelisation of water, treated wastewater was observed discharging into the pond at three discrete locations after dispersing at the top of the slope. All treated wastewater flows into the farm pond, where it mixes with water entering the pond through the pond inlet on the eastern side. Pond inlet flows have been very low during the sampling period. The treated wastewater collected in the pond then flows out on the western side. The approximate sampling locations and zone boundaries are shown in Figure 1. Photographs were taken at each sampling location and are shown in Appendix B.

2.2 Sampling and Analysis

2.2.1 Treated wastewater sampling methodology

Grab samples of treated wastewater were collected weekly from the system. One sample of the discharged treated wastewater taken from the dispersal pipes at the top of the zones[1], a set of wastewater samples was collected from the bottom of the slope from each zone (labelled A Bottom, B Bottom, and C Bottom, respectively), and finally samples were also collected at the inlet and outlet of the farm pond.

The collected treated wastewater samples were sent to Hill Laboratories for analysis. All samples were tested for the following parameters:

- pH
- Electrical Conductivity (EC)
- Chloride
- Sodium
- Carbonaceous Biochemical Oxygen Demand (BOD)
- Turbidity
- Total Nitrogen (TN)
- Ammoniacal-N (NH_4-N)
- Nitrate-N (NO_3-N)
- Nitrite-N (NO_2-N)
- Total Kjeldahl Nitrogen (TKN)
- Total Oxidised Nitrogen (TON)
- Total Phosphorus (TP)
- Dissolved Reactive Phosphorus (DRP)
- Escherichia coli (*E. coli*)
- Faecal coliforms
- Chlorophyll a

[1] Note that for the first two sampling rounds separate samples were taken from the top of each zone (A Top, B Top, and C Top). Due to consistent results across the top of the zones this was reduced to only one sample to represent all the dispersed wastewater from round three onwards.

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FIGURE 1: SAMPLING LOCATIONS

WATERCARE BEACHLANDS MARAETAI WWTP

SOURCE:
1. AERIAL IMAGERY: EAGLE TECHNOLOGY, LINZ, STATSNZ, NIWA, NATURAL EARTH, © OPENSTREETMAP CONTRIBUTORS., EAGLE TECHNOLOGY, LAND INFORMATION NEW ZEALAND, GEBCO, COMMUNITY MAPS CONTRIBUTORS.

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CLIENT: WATERCARE SERVICES LIMITED

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All sampling has been carried out on days without heavy rain to minimise dilution of samples on the slope from rainfall and to manage health and safety risks. PDP also took field measurements of dissolved oxygen (DO), pH, conductivity, and temperature at each sampling location shown in Figure 1.

3.0 General Field Observations

The slope area was densely vegetated, and avian presence was observed in the farm pond. The inlet was shallow, measuring less than 5 cm in depth, and stagnant. The highest flow rate was consistently in the dispersion lines recorded in Zone C, while Zones A and B exhibited minimal flow in both rounds of sampling. Channelisation was observed at the bottom of the slope, where the discharged treated wastewater formed a stream in each zone especially at the bottom of Zone C (Refer to Appendix B for site photographs). There was notably more flow at the bottom of Zone C compared to Zones A and B due to the higher flowrate at the discharge.

As noted in Memorandum 1, the dispersal system operates on demand via gravity from the WWTP. The dispersal system has not been designed to evenly distribute wastewater across the slopes and sub-optimal maintenance of the dispersion lines has exacerbated this problem. The discharge of wastewater across the slope varies significantly based on the instantaneous flowrate of wastewater from the WWTP. There are currently no systems in place to control or measure this variation in flow within the overland flow system. This means that the results should be interpreted with caution, particularly when considering the overall overland flow system performance.

Based on the observations to date, Zone C is the primary zone dispersion of low to average dry weather flows. Lower discharge rates have been observed in Zone A and Zone B, these zones have consistently had the lowest application rate during PDP's site visits.

During the third and fourth rounds of sampling, PDP observed a decrease in both the pond and inlet levels compared to the preceding rounds. Additionally, no treated wastewater was being dispersed at the top Zones A and B, along with the dispersion lines. Consequently, minimal flows were observed at the bottom of the slope in Zones A and B. This lack of flow made it challenging to obtain samples from these locations without disturbing sediment or picking up solids. Results for these zones in rounds three and four should be interpreted with caution.

4.0 Results and Discussion

4.1 Assessment Methodology

PDP reviewed the sampling results and provided analysis of the treatment efficiency across the multiple treatment processes. Based on comparison of key contaminant concentrations at different stages in the disposal system we have provided commentary on:

- The general treatment effectiveness of the overland flow area.
- Performance of and variance between individual zones of the overland flow area.
- Overall treatment effectiveness of the combined overland flow/pond system.
- Estimated contribution of the farm pond to overall treatment performance.

4.2 General Observations

This section presents the results from the first four rounds of sampling and compares them with the assumptions and findings previously documented in (PDP, 2024). The raw laboratory results are shown in Appendix A. The key observations and conclusions based on the available laboratory results are as follows:

- The majority of contaminants in the pond and outlet can be attributed to the treated wastewater discharge, as indicated by the consistent concentrations of total sodium and chloride across the slopes and to the pond outlet. Nutrient concentrations (various nitrogen and phosphorus species) were much lower in the inlet compared to the outlet of the farm pond and discharged treated wastewater.
- EC, total sodium, and chloride levels stayed relatively similar across the sampling points indicating that the OLF slope and the farm pond do not alter these parameters. This provides evidence that the assumptions made previously in Memorandum 2 were generally correct.
- BOD levels were generally below the laboratory detection limit of 2 g/m³ across all samples collected from the OLF slope, including the treated wastewater from the dispersion lines. No detectable increase in BOD was generated across the OLF slope or through the pond. Outliers in BOD levels were noted in samples collected from the bottom of Zone B and the inlet from the third and fourth rounds of sampling, this was due to low wastewater flow in these zones, leading to disturbance and sediment pickup during sample collection
- Turbidity levels slightly increased as treated wastewater flowed through the OLF slope, with notably elevated levels at the inlet and bottom of Zones A and B during the third sampling round. These are considered outliers due to low wastewater flow in these zones, leading to disturbance and sediment pickup during sample collection. The general increase in turbidity across the slope highlights the risk identified in Memorandum 2 regarding potential TSS increases in certain OLF systems. However, the water discharged from the slopes still have excellent clarity with turbidity <5 NTU on average.
- PDP highlighted the risk of increasing BOD and TSS concentrations in Memorandum 2. No increase in BOD was detected and the increase in turbidity was relatively low. It appears that this risk is low with the slope grade and planting of the existing OLF.
- Chlorophyll-a levels were below the laboratory detection limit of 0.003 g/m³ across all samples, except for the inlet. This indicates that there is not significant growth of algae except for the stagnant area near the pond inlet which exhibited slightly higher chlorophyll-a levels consistent with observations of algal growth during sampling.
- Faecal coliforms and *E. coli* were generally low at the dispersion lines across all zones and increased as the treated wastewater flowed through the OLF and the pond. This confirms that the risks of increasing pathogen loads over the slope and through the pond raised in PDP Memorandum 2 are currently being realised.

In addition to the general trends identified above, notable trends around reduction or increase in the key nutrient levels and the treatment performance of the OLF system around removal of these nutrients are discussed in further detail in Sections 4.2 - 4.5.

From the initial laboratory results, the samples from dispersion lines (A Top, B Top, and C Top) show roughly equal contaminant concentrations. This was expected; however, it was necessary to confirm that residence time in the dispersal system was not modifying the nature of the influent wastewater. From the third round of sampling onwards, only one sample has been collected from the dispersion lines in Zone C.

4.3 Total Nitrogen Performance

The total nitrogen (TN) levels in the treated wastewater discharge were marginally lower than the previously reported median of 5.02 g/m³. Similarly, the total nitrogen levels at the farm pond outlet ranged from 3.2 to 4.2 g/m³, which is marginally lower than the previously reported median concentration of 3.7 g/m³.

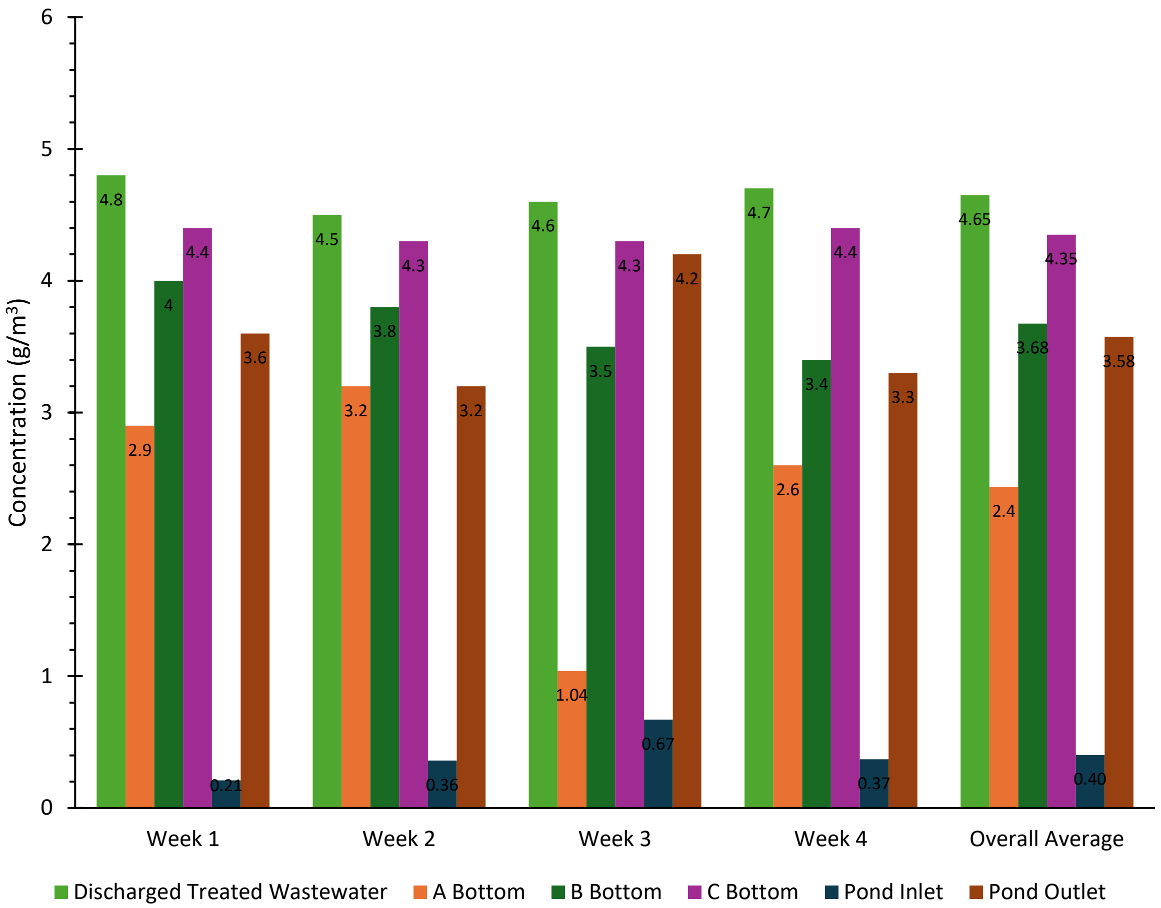

Figure 2: Total Nitrogen Concentrations

- TN removal was observed across all zones, although the removal efficiency varied.
- Zone A exhibited the highest TN removal, with an average of 48%, followed by Zones B and C with 21% and 6% removal, respectively.
- The lower removal efficiency in Zone C is likely due to higher flow rates, steeper slopes, and greater channelisation, resulting in lower retention time on the OLF slope and thus lower treatment levels.
- Based on estimates of the flows to each zone, the preliminary results indicate the pond is still the primary means of TN removal. However, the higher levels of removal in Zones A and B indicate that there is potential for achieving higher levels of removal than is currently being achieved with the majority of the wastewater discharged preferentially to Zone C. Good design and operation of the slopes will be key to achieving improved results.
- The combined OLF slope and pond reduction in TN is consistent with the 30% removal determined in Memorandum 2.

4.4 Ammoniacal Nitrogen Performance

The ammoniacal nitrogen levels in the treated wastewater discharge is higher than what was previously reported (0.06 g/m^3 vs 0.03 g/m^3). However, the ammoniacal nitrogen levels return to the levels similar to the previously reported median concentration of 0.03 g/m^3 at the bottom of the slope.

At the farm pond outlet, the ammoniacal nitrogen levels have slightly decreased, averaging 0.14 g/m^3 compared to the previously reported median concentration of 0.28 g/m^3.

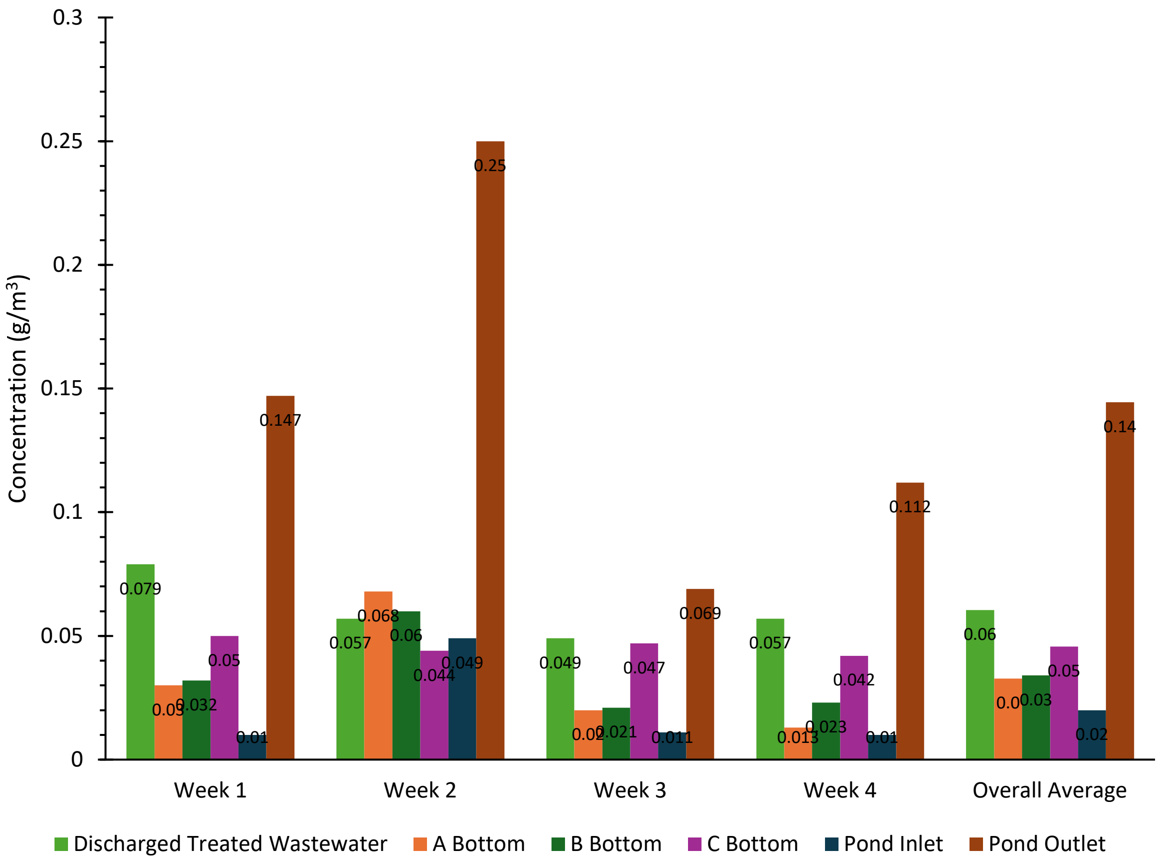

Figure 3: Ammoniacal Nitrogen Concentrations

It should be noted that, negative removal efficiency means increase in contaminant levels.

- Overall, there is a decrease in ammoniacal nitrogen from the top to the bottom of the OLF slope, with removal efficiency varying across the zones, mirroring trends observed in TN concentrations. Zone A demonstrated the highest average removal efficiency at 66%, followed by Zone B and Zone C at 56% and 22%, respectively. This general decease in ammoniacal nitrogen across the OLF slope suggests that the existing setup adequately maintains aerobic conditions for the current treated wastewater flows and loads.

- There is a significant increase in ammoniacal nitrogen in the pond as was previously assumed in Memorandum 2. Over this sampling period the ammonia concentration increases 285% across the farm pond from the bottom of the overland flow area. It is noted that the concentration of ammoniacal nitrogen in the discharge is generally elevated above that reported in Memorandum 2, likely due to the smaller data set, and this may explain why the results indicate a lower increase in ammoniacal nitrogen than the 8.74 times increase previously reported in Memorandum 2.

- As previously reported, the generation of ammoniacal nitrogen is likely due to mineralisation (ammonification) of organic nitrogen within an anaerobic base layer in the pond, and potential contamination from avian life consistently present during sampling. This leads to an increase in ammoniacal nitrogen in the OLF system overall.
- As noted in Memorandum 2, this elevated ammoniacal nitrogen concentration was rapidly reduced downstream of the pond.

4.5 Nitrate Performance

The nitrate levels in the treated wastewater discharge were lower than previously reported, ranging from 3.3 to 3.7 g/m³, compared to the previously reported median of 5.02 g/m³. At the farm pond outlet, the nitrate levels were also slightly lower, ranging from 2 to 2.43 g/m³, compared to the previously reported median concentration of 2.71 g/m³.

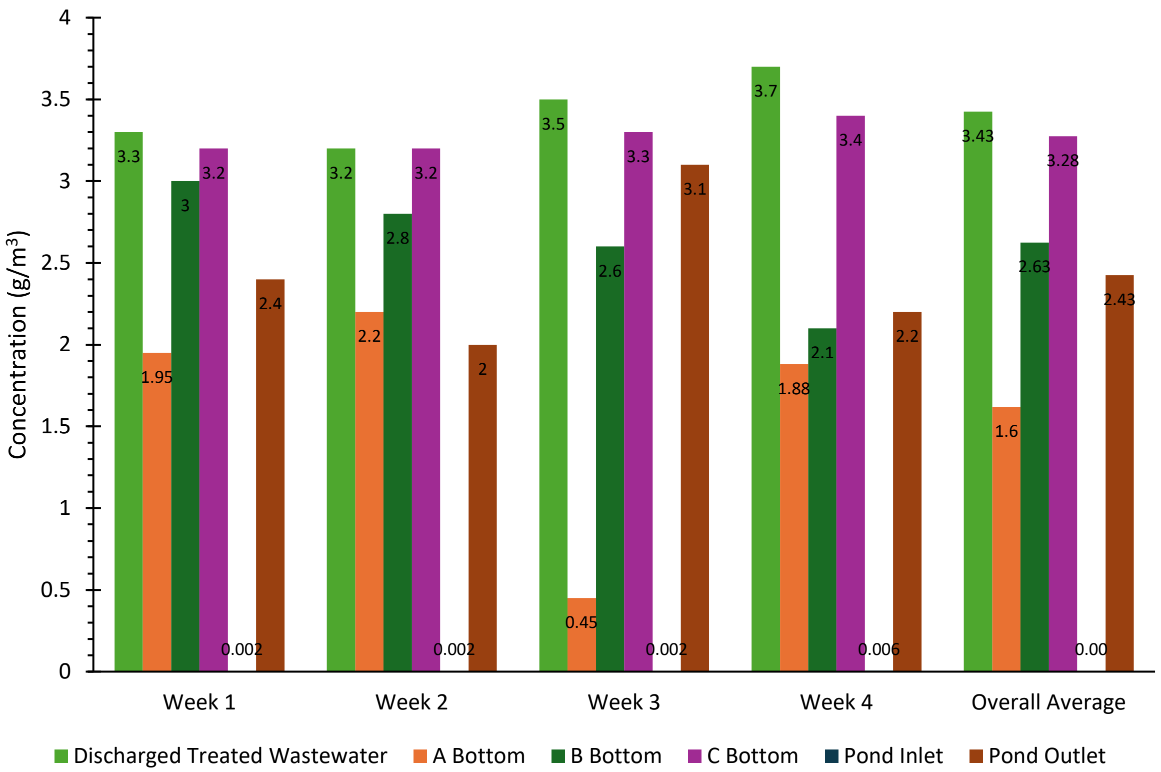

Figure 4: Nitrate Concentrations

- Similar to the TN results, Zone A exhibited the highest nitrate removal, with an average of 53% over two weeks, followed by Zone B with 23% and Zone C with 4%.
- The lower removal efficiency in Zones B and C is likely due to higher flow rates, steeper slopes, and greater channelisation, resulting in lower retention time on the OLF slope and thus lower treatment levels.
- Based on estimates of the flows to through zone, the preliminary results indicate the pond is still the primary means of nitrate removal. However, the higher levels of removal in Zones A indicates that there is potential for achieving higher levels of removal than is currently being achieved with the majority of the wastewater discharged preferentially to Zone C. Good design and operation of the slopes will be key to achieving improved results.

- The combined OLF slope and pond provided a 30% reduction in nitrate, similar to the previously quantified 36% in Memorandum 2.

4.6 Total Phosphorus Performance

Total phosphorus (TP) levels in the treated wastewater discharge were lower than previously reported, with an average concentration of 0.37 g/m³ compared to the previously reported median of 0.87 g/m³.

Similarly, TP levels at the farm pond outlet were slightly lower than previously reported, averaging 0.36 g/m³ compared to the previously reported median concentration of 0.47 g/m³.

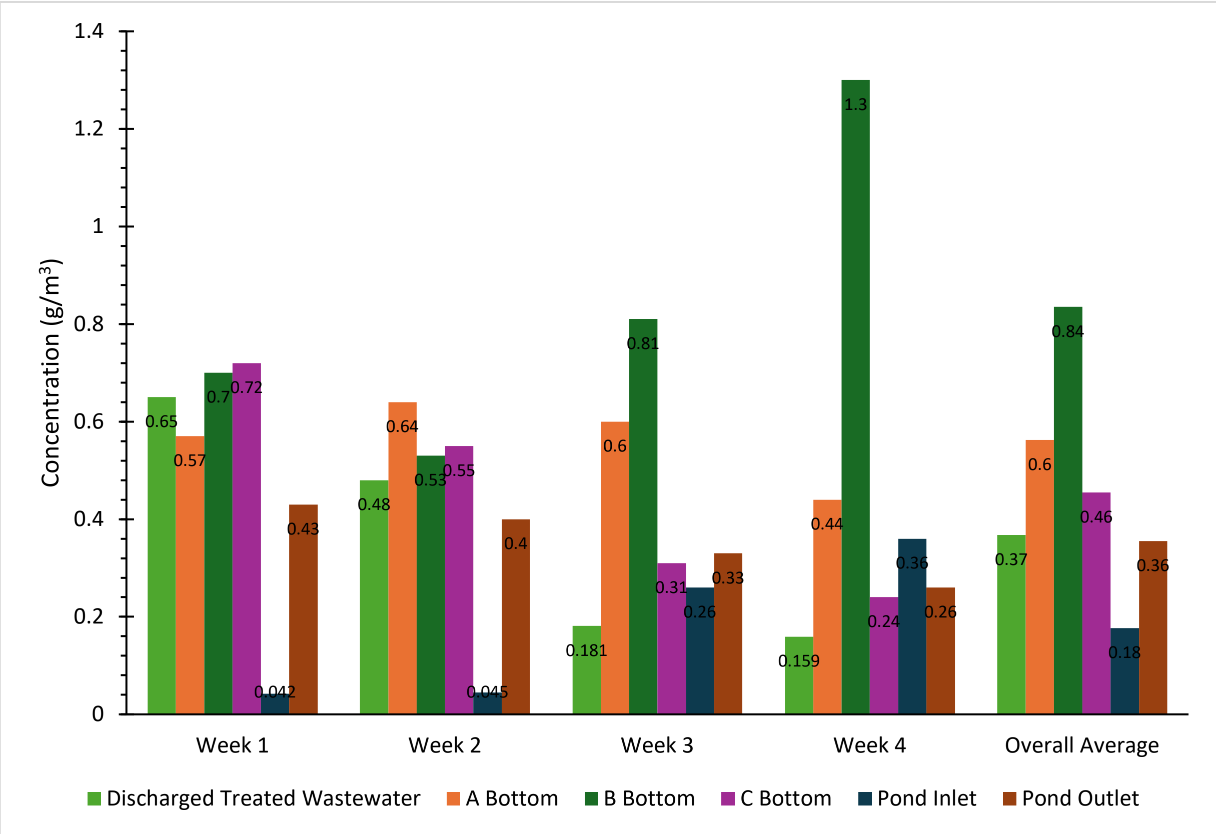

Figure 5: Total Phosphorus Concentrations

- There were increase in TP levels across all zones. These were generally small with average increases of 4%, 9%, and 13% in Zones A, B, and C, respectively during weeks one and two. Large increases were seen in weeks three and four, however, these results should be interpreted with care as wastewater was not being dispersed onto these zones at the time of sampling.
- Increases in TP is likely associated with an increase in suspended solids as the treated wastewater flows down the OLF slope, as evidenced by the increase in turbidity across the slope areas (See Appendix A).
- Overall, pond outlet concentrations were relatively consistent over the four sampling rounds. Increases or decreases seem to be as a result of fluctuating treated wastewater concentrations. This could indicate the wastewater is reaching an equilibrium with phosphorous in soil producing relatively consistent final results.

4.7 Dissolved Reactive Phosphorus Performance

Dissolved reactive phosphorus (DRP) levels in the treated wastewater discharge were lower than previously reported, with an average concentration of 0.27 g/m³ based on the lab results, compared to the previously reported median of 0.73 g/m³. At the farm pond outlet, DRP levels were also slightly lower, with an average of 0.25 g/m³ compared to the previously reported median concentration of 0.38 g/m³.

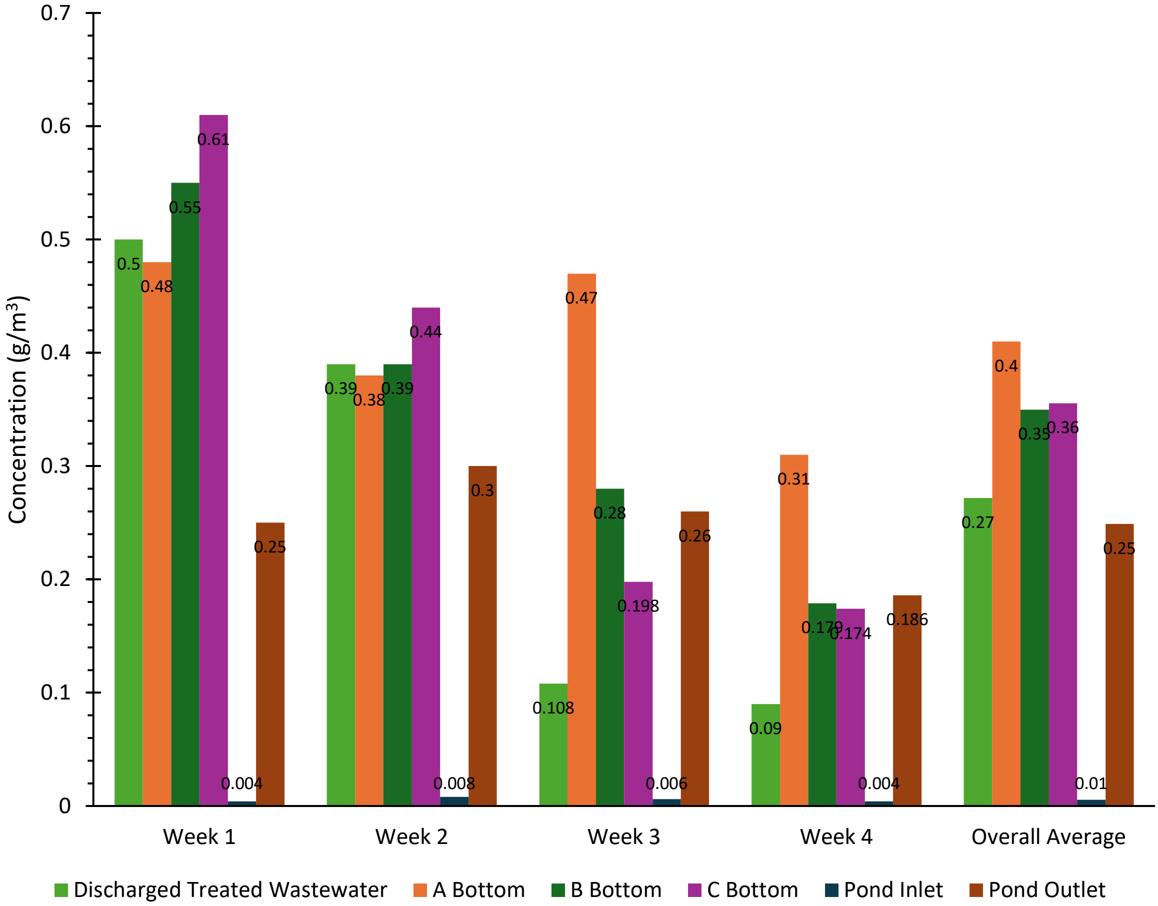

Figure 6: Dissolved Reactive Phosphorus Concentrations

- Similar to the trend observed from TP removal performance, the treatment performance varied across the zones, but overall, the average DRP level across the zones increased by 85%.
- Similar to TP removal, the majority of DRP removal was achieved in the pond, which provided an average removal of 28%.

5.0 Summary

PDP has completed six sampling rounds at the date of this memorandum, however, only four rounds of lab results have been received. The sampling consists of samples from the dispersal system, an individual sample from the lower section of Zones A, B, and C, the pond inlet, and the pond outlet. The results have been analysed and interpreted as follows:

- Concentrations of sodium and chloride indicate the flows out of the farm pond are almost entirely wastewater over the sampling period.
- Previous assumptions about negligible change in electrical conductivity through the system (Memorandum 2) are likely correct.

- The uneven and inconsistent nature of the dispersion system is reducing the level of treatment provided by the overland flow slopes. Similarly, the absence of gentle, well graded slopes and rapid concentration/channelisation of wastewater within Zones B and C is reducing the performance of these zones. An improved dispersion system and better preparation of the slopes to promote sheet flow may result in improved performance of the existing overland flow system.
- The overland flow area is providing some removal of contaminants, particularly in Zone A where the application rate is lower. However, based on preliminary results, the pond provides the majority (>50 %) of treatment for key contaminants including total nitrogen, nitrate-nitrogen, total phosphorus and dissolved reactive phosphorus.
- Ammoniacal-nitrogen concentrations generally decrease over the overland flow area; however, ammoniacal-nitrogen concentrations increase in the pond. As detailed in Memorandum 2, this is thought to be due to mineralisation of organic nitrogen in anaerobic areas of the pond/pond base. Avian faecal matter may also make a minor contribution to this increase.
- Risks of increase BOD and TSS/turbidity concentrations highlighted in Memorandum 2 were not realised in the sampling completed to date. However, there is a clear increase in faecal contamination post discharge to the top of the overland flow slopes. Faecal coliform counts increase both over the slopes and through the pond, most likely from avian sources. These results are consistent with elevated faecal coliform counts detected in the upstream catchment.
- **Generally, the sampling completed to date confirms the assumptions made and anticipated results previously set out in PDP Memorandum 2**.

These conclusions are preliminary only and should be considered indicative only. Sampling work continues and this memorandum will be updated following the completion of the scheduled ten-week sampling programme. The final results, interpretation, and conclusions drawn may change as a result of analysis of a larger dataset. These final results will be used to inform the design process of any modification or expansion to the Beachlands overland flow system.

6.0 Limitations

This memorandum has been prepared by Pattle Delamore Partners Limited (PDP) on the basis of information provided by Watercare Services Ltd and others (not directly contracted by PDP for the work), including Aquatic Environmental Sciences Ltd. PDP has not independently verified the provided information and has relied upon it being accurate and sufficient for use by PDP in preparing the memorandum. PDP accepts no responsibility for errors or omissions in, or the currency or sufficiency of, the provided information.

This memorandum has been prepared by PDP on the specific instructions of Watercare Services Ltd for the limited purposes described in the memorandum. PDP accepts no liability if the memorandum is used for a different purpose or if it is used or relied on by any other person. Any such use or reliance will be solely at their own risk.

PATTLE DELAMORE PARTNERS LIMITED

Yours faithfully

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Appendix A: Laboratory Results

Laboratory Results

Sample Name	Date	Turbidity	pH	EC	Total Sodium	Chloride	TN	TKN	TON	TP	cBOD5	Chlorophyll a	Faecal Coliforms	E. coli	NH4-N	NO2-N	NO3-N	NO3-N + NO2-N	DRP
		NTU	pH Units	mS/m	g/m^3	g/m^3	g/m^3	g/m^3	g/m^3	g/m^3	g O2/m^3	g/m^3	cfu/100mL	cfu/100mL	g/m^3	g/m^3	g/m^3	g/m^3	g/ g/m^3
Inlet	9/04/2024	9.7	6.6	43	62	110	0.21	0.21	0.21	0.042	< 2	0.005	160	150	< 0.01	< 0.002	< 0.002	< 0.002	< 0.004
Outlet	9/04/2024	7.4	7.3	238	400	710	3.6	1.15	1	0.43	< 2	< 0.003	250	250	0.147	0.096	2.4	2.5	0.25
A Top	9/04/2024	1	7.1	240	370	710	4.9	1.18	1.1	0.66	< 2	< 0.003	< 10	< 10	0.079	0.21	3.5	3.7	0.59
A Bottom	9/04/2024	6.2	7.2	242	400	660	2.9	0.95	0.92	0.57	< 2	< 0.003	320	310	0.03	0.004	1.95	1.96	0.48
B Top	9/04/2024	0.85	7.1	239	390	680	4.8	1.24	1.16	0.64	< 2	< 0.003	90	50	0.085	0.23	3.3	3.5	0.53
B Bottom	9/04/2024	9.9	7.7	240	400	710	4	1.07	1.04	0.7	< 2	< 0.003	120	120	0.032	0.008	3	3	0.55
C Top	9/04/2024	1.09	7	239	390	700	4.8	1.25	1.17	0.65	< 2	< 0.003	40	40	0.079	0.24	3.3	3.5	0.5
C Bottom	9/04/2024	3	7.3	240	390	640	4.4	1.09	1.04	0.72	< 2	< 0.003	80	70	0.05	0.034	3.2	3.3	0.61
Inlet	17/04/2024	10	6.7	42.6	59	111	0.36	0.36	0.31	0.045	< 2	0.041	420	420	0.049	< 0.002	0.002	0.002	0.008
Outlet	17/04/2024	2.3	7.6	286	450	840	3.2	1.09	0.84	0.4	< 2	< 0.003	130	130	0.25	0.056	2	2.1	0.3
A Top	17/04/2024	0.52	7.1	257	390	750	4.5	1.05	0.86	0.53	< 2	< 0.003	< 10	< 10	0.187	0.13	3.3	3.5	0.42
A Bottom	17/04/2024	17.6	7.6	266	420	730	3.2	0.98	0.91	0.64	< 2	< 0.003	640	630	0.068	0.002	2.2	2.2	0.38
B Top	17/04/2024	0.66	7.2	260	400	740	4.5	1.1	1.02	0.49	< 2	< 0.003	20	20	0.082	0.167	3.3	3.4	0.41
B Bottom	17/04/2024	6.5	7.5	262	390	750	3.8	1	0.94	0.53	< 2	< 0.003	440	160	0.06	0.002	2.8	2.8	0.39
C Top	17/04/2024	0.83	7.1	262	400	720	4.5	1.08	1.02	0.48	< 2	< 0.003	60	60	0.057	0.186	3.2	3.4	0.39
C Bottom	17/04/2024	3.5	7.6	260	400	730	4.3	1.08	1.04	0.55	< 2	< 0.003	300	300	0.044	0.029	3.2	3.3	0.44
Pond Inlet	30/04/2024	33	6.4	28.6	39	62	0.67	0.67	0.66	0.26	12	0.006	< 100	< 100	0.011	< 0.002	< 0.002	0.002	0.006
Pond Outlet	30/04/2024	2.1	7.6	159	260	380	4.2	1.04	0.97	0.33	< 2	< 0.003	500	500	0.069	< 0.10	3.1	3.1	0.26
C Top	30/04/2024	0.57	7.3	155.4	260	350	4.6	1.1	1.05	0.181	< 2	< 0.003	< 10	< 10	0.049	< 0.10	3.5	3.5	0.108
A Bottom	30/04/2024	25	7.4	157.6	250	360	1.04	0.58	0.56	0.6	< 2	< 0.003	400	400	0.02	< 0.10	0.45	0.45	0.47
B Bottom	30/04/2024	37	7.4	152.4	250	340	3.5	0.85	0.83	0.81	4	< 0.003	300	300	0.021	< 0.10	2.6	2.6	0.28
C Bottom	30/04/2024	6.2	7.6	155.8	260	360	4.3	1.03	0.98	0.31	2	< 0.003	220	160	0.047	< 0.10	3.3	3.3	0.198
Inlet	3/05/2024	106	7	27.9	38	64	0.37	0.36	0.36	0.36	7	0.128	10	10	< 0.010	< 0.002	0.006	0.006	< 0.004
Outlet	3/05/2024	2	7.9	177.9	270	410	3.3	1.02	0.91	0.26	< 2	< 0.003	150	100	0.112	< 0.10	2.2	2.3	0.186
C Top	3/05/2024	0.62	7.2	155.6	240	350	4.7	1.03	0.97	0.159	< 2	< 0.003	180	< 10	0.057	< 0.10	3.7	3.7	0.09
A Bottom	3/05/2024	10.7	7.9	163.1	260	370	2.6	0.71	0.7	0.44	< 2	< 0.003	1000	1000	0.013	< 0.10	1.88	1.88	0.31
B Bottom	3/05/2024	116	7.3	153.9	250	360	3.4	1.24	1.22	1.3	< 2	< 0.003	280	260	0.023	< 0.10	2.1	2.1	0.179
C Bottom	3/05/2024	5.8	7.6	156.2	250	370	4.4	0.98	0.94	0.24	< 2	< 0.003	160	160	0.042	< 0.10	3.4	3.5	0.174
Pond Inlet avg.		17.6	6.6	38	53	94	0.4	0.41	0.4	0.12	5.3	0.017	227	223.3	0.0	0.0	0.0	0.0	0.0
Pond Outlet avg.		3.9	7.5	228	370	643	3.7	1.09	0.94	0.39	2	0.003	293	293.3	0.2	0.1	2.5	2.6	0.270
A Top avg.		0.7	7.2	217	340	603	4.7	1.11	1.00	0.46	2	0.003	10	10.0	0.1	0.1	3.4	3.6	0.373
A Bottom avg.		16.3	7.4	222	357	583	2.4	0.84	0.80	0.60	2	0.003	453	446.7	0.0	0.0	1.5	1.5	0.443

B Top avg.		0.7	7.2	218	350	590	4.6	1.15	1.08	0.44	2	0.003	40	26.7	0.1	0.2	3.4	3.5	0.349
B Bottom avg.		17.8	7.5	218	347	600	3.8	0.97	0.94	0.68	2.7	0.003	287	193.3	0.0	0.0	2.8	2.8	0.407
C Top avg.		0.8	7.1	219	350	590	4.6	1.14	1.08	0.44	2	0.003	37	36.7	0.1	0.2	3.3	3.5	0.333
C Bottom avg.		4.2	7.5	218.6	350	577	4.3	1.07	1.02	0.53	2	0.003	200	176.7	0.0	0.1	3.2	3.3	0.416

Notes:

1. *Type notes here values denoted as "less than", "<" are lower than the laboratory detection limits.*

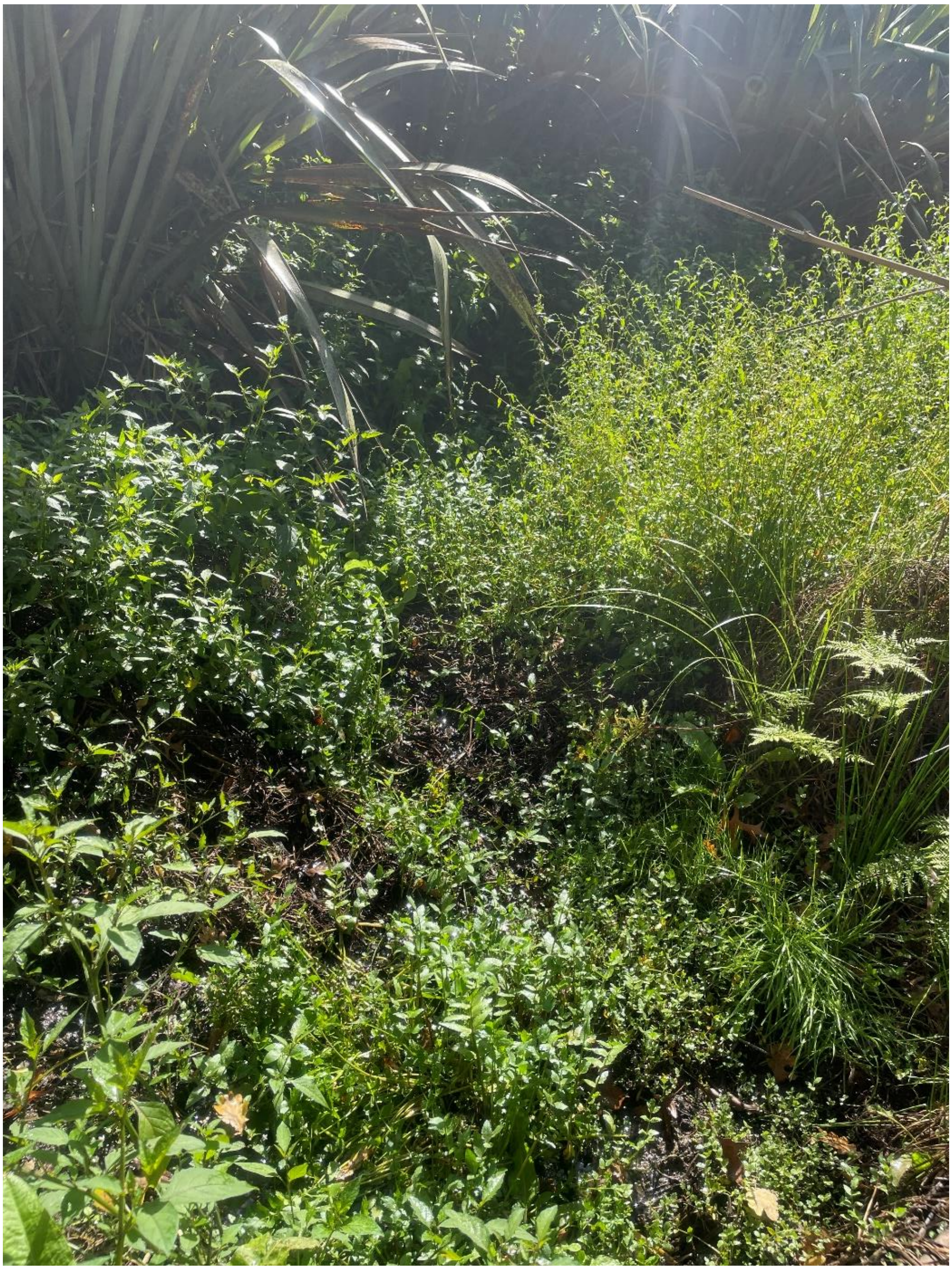
Appendix B: Site Photographs

A Top Sampling Point

B Top Sampling Point

C Top Sampling Point

A Bottom Sampling Point



B Bottom Sampling Point

C Bottom Sampling Point

Pond Inlet Sampling Point

Pond Outlet Sampling Point