

# Beachlands WWTP Overland Flow System Performance

• Prepared for

Watercare Services Limited

• August 2024

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## Quality Control Sheet

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## 1.0 Background

Watercare Services Ltd (**Watercare**) submitted a 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 report has been prepared to describe the methodology used and the results of the OLF and Pond investigations undertaken between 9 April 2024 and 12 June 2024.

## 2.0 Investigations

### 2.1 Overland Flow System and Farm Pond Overview

#### 2.1.1 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<sup>1</sup>, a set of wastewater samples was collected from the bottom of the slope from each zone (labelled A Bottom, B Bottom, and C Bottom,

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<sup>1</sup> 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.

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   | ∴ Nitrite-N (NO <sub>2</sub> -N)      |
| ∴ Electrical Conductivity (EC)                 | ∴ Total Kjeldahl Nitrogen (TKN)       |
| ∴ Chloride                                     | ∴ Total Oxidised Nitrogen (TON)       |
| ∴ Sodium                                       | ∴ Total Phosphorus (TP)               |
| ∴ Carbonaceous Biochemical Oxygen Demand (BOD) | ∴ Dissolved Reactive Phosphorus (DRP) |
| ∴ Turbidity                                    | ∴ Escherichia coli ( <i>E. coli</i> ) |
| ∴ Total Nitrogen (TN)                          | ∴ Faecal coliforms                    |
| ∴ Ammoniacal-N (NH <sub>4</sub> -N)            | ∴ Chlorophyll a <sup>2</sup>          |

All sampling was 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.

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<sup>2</sup> Note that for the first four sampling rounds, testing was conducted for chlorophyll-a. Due to the results showing non-detects this was not included in testing from round five onwards.





FIGURE 1: SAMPLING LOCATIONS

WATERCARE BEACHLANDS MARAETAI WWTP

SOURCE:  
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### 3.0 General Field Observations

Based on PDP's visits to the overland flow site, one scoping and ten sampling visits, the following observations have been made:

- ∴ The slope area is densely vegetated, and there were a large number of birds frequently observed in the farm pond.
- ∴ The pond inlet sampling point was shallow, measuring less than 5 cm in depth, and stagnant.
- ∴ The highest flow rate was consistently observed in Zone C, while Zones A and B generally exhibited lower flows and at times zero flow was observed in the dispersion lines in Zones A and B.
- ∴ Channelisation was observed at the bottom of the slope, where the discharged treated wastewater formed streams in each zone especially at the bottom of Zone C (Refer to Appendix B for site photographs).

As noted in Memorandum 1, the dispersal system operates on demand via gravity from the WWTP (PDP, 2024). The dispersal system does not 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, 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. The field observations for each sample round are summarised in Table 1 below.

Table 1: Field Observations			
Sample Round	Date	Weather Conditions	Comments
1	09/04/2024	Sunny, partially cloudy	
2	17/04/2024	Sunny, partially cloudy	
3	30/04/2024	Cloudy, light showers	<ul style="list-style-type: none"> <li>∴ There were decreased pond and inlet levels compared to preceding rounds.</li> <li>∴ No wastewater was discharged from the top of zones A or B, and consequently minimal flows were observed at the bottom of zones A and B. These results should be interpreted with caution and could be influenced by sediment disturbed during the sampling procedure.</li> </ul>
4	03/05/2024	Sunny, partially cloudy	<ul style="list-style-type: none"> <li>∴ There were decreased pond and inlet levels compared to preceding rounds.</li> <li>∴ No wastewater was discharged from the top of zones A or B, and consequently minimal flows were observed at the bottom of zones A and B. These results should be interpreted with caution and could be influenced by sediment disturbed during the sampling procedure.</li> </ul>
5	08/05/2024	Sunny, clear skies	
6	14/05/2024	Cloudy	<ul style="list-style-type: none"> <li>∴ There were decreased pond and inlet levels compared to preceding rounds.</li> <li>∴ Decreased wastewater was discharged from the top of zones A or B, and consequently minimal flows were observed at the bottom of zones A and B. These results should be interpreted with caution and could be influenced by sediment disturbed during the sampling procedure.</li> </ul>
7	22/05/2024	Sunny	∴ Heavy rainfall of 49.8 mm was recorded at a nearby weather station on the previous day. Results for this round may be indicative of wet weather wastewater flows.
8	31/05/2024	Sunny, partially cloudy	<ul style="list-style-type: none"> <li>∴ Higher flows and the formation of bubbles were observed at the bottom of Zones A and C. These bubbles were assumed to be naturally occurring foam.</li> <li>∴ 27.6 mm of rainfall was recorded at a nearby weather station over the two days before this sample round. Results for this round may be indicative of wet weather wastewater flows.</li> </ul>
9	07/06/2024	Cloudy, light showers	<ul style="list-style-type: none"> <li>∴ No treated wastewater was being discharged to the overland flow area. Watercare advised this was due to a power failure, which was to be restored later that day. These results should be interpreted with caution and could be influenced by sediment disturbed during the sampling procedure.</li> <li>∴ PDP observed signs of recent stock presence within and surrounding the overland flow area including manure and pugging.</li> </ul>
10	12/06/2024	Sunny, partially cloudy	∴ 22.4 mm of rainfall was recorded at a nearby weather station two days before this sample round. Results for this round may be indicative of wet weather wastewater flows.

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## 4.0 Results and Discussion

### 4.1 Assessment Methodology

PDP has reviewed the sampling results and analysed the treatment efficiency across the different system. 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.

This section presents the results from the ten rounds of sampling and compares them with the assumptions and findings previously documented in Memorandum 2 (PDP, 2024). The full set of plots for each parameter are shown in Appendix A. The raw laboratory results are shown in Appendix C.

### 4.2 Wastewater Flows

During the sampling period wastewater flows ranged from 850 m<sup>3</sup>/d to 3750 m<sup>3</sup>/d. Most samples were collected during average flow conditions (dry weather) between 1,300 and 1,700 m<sup>3</sup>/d, however, three samples were collected during elevated flow conditions between 2,600 and 3,200 m<sup>3</sup>. These elevated flow conditions coincided with rainfall. The sampling dates are presented below in Figure 2 in relation to the daily effluent flowrate and rainfall data obtained from the Auckland Airport weather station.

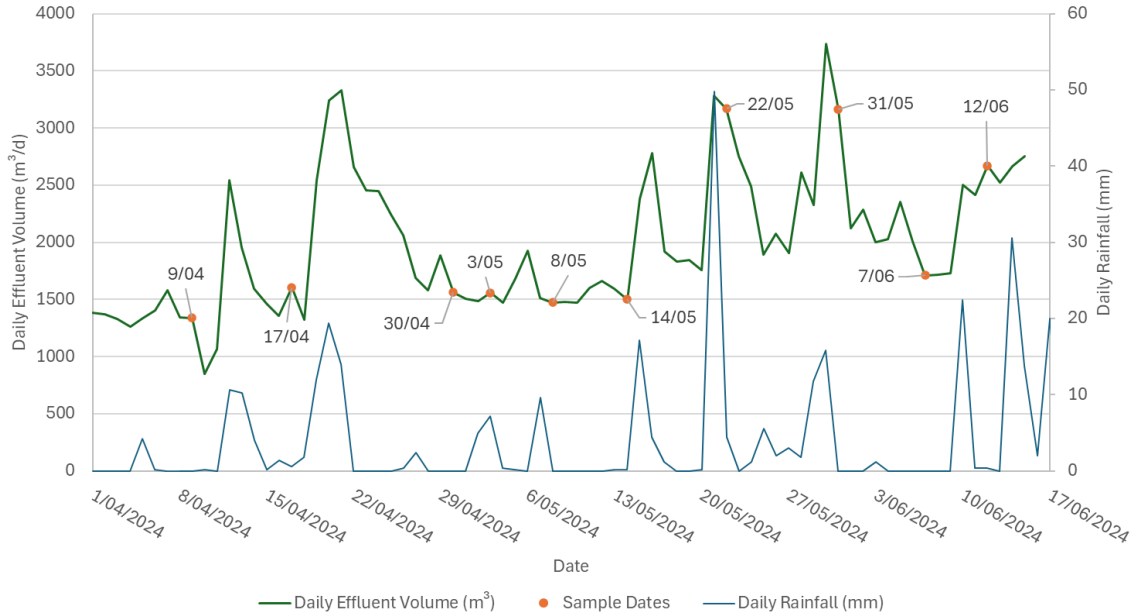


Figure 2: Wastewater flows and rainfall during the sampling period.

### 4.3 Dilution Assessment

During the previous performance assessment (PDP Memorandum 2), electrical conductivity (EC) was used as a proxy for dilution to provide an estimate of the treatment provided through the combined overland flow/pond system.

As shown below in Figure 3, both Total Sodium and EC showed very little variation from the top of the slope to the outlet of the pond. This contrasts with the previous data set where there was an approximately 15% reduction in electrical conductivity from 141 to 122 mS/m. Over this set of sampling data, the electrical conductivity was slightly higher, with a median of 156 mS/m at the top of the slope and 157 mS/m at the outlet of the pond.

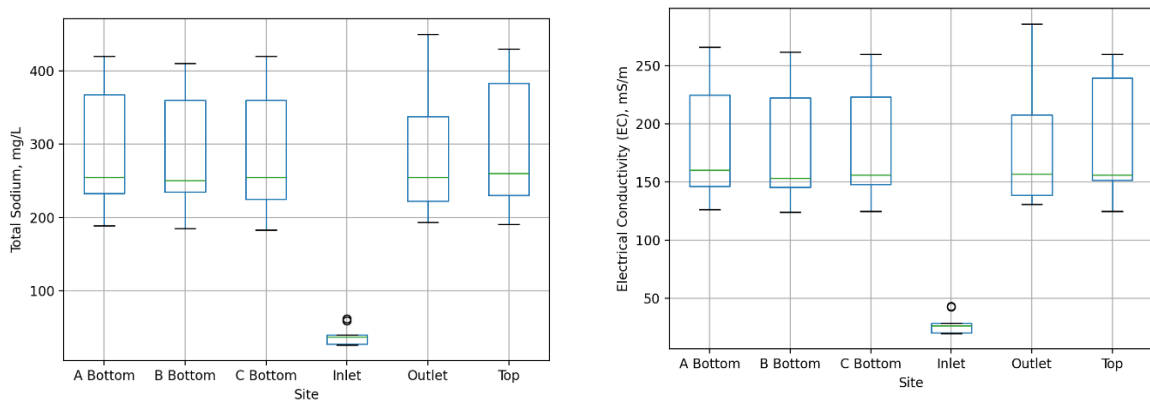
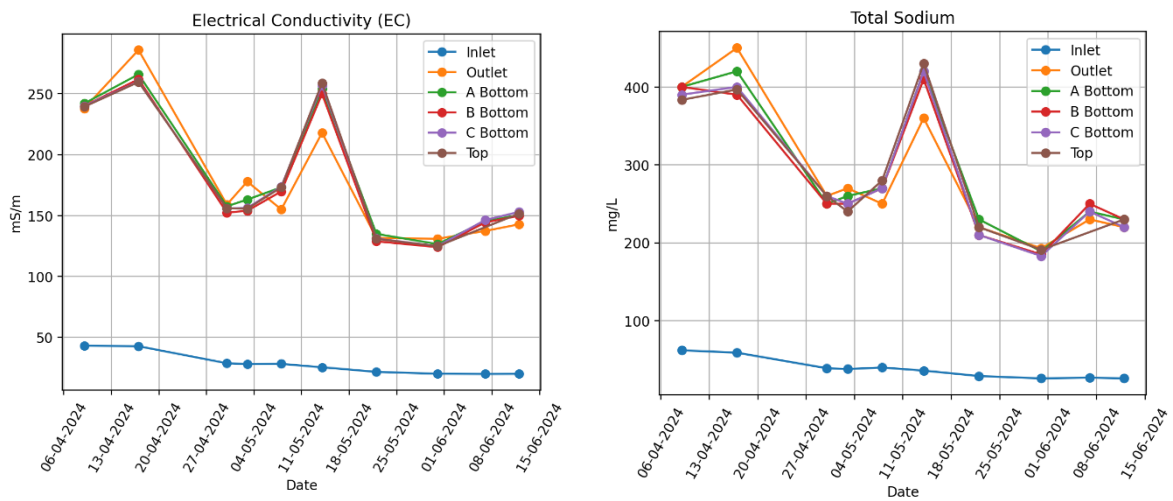


Figure 3: Box and Whisker Plots for Electrical Conductivity and Total Sodium.

Comparison of the individual sampling results shows that conductivity varied from 125 mS/m to 260 mS/m in the WWTP effluent as shown below in Figure 4. Conductivity in the bottom of slope samples and the pond outlet were generally closely matched to the effluent quality. Changes in conductivity from the WWTP effluent to the pond outlet ranged from a 15% increase to a 15% decrease. There was no obvious trend considering WWTP effluent flowrate or rainfall. The pond may allow for a small amount of buffering which could explain the slight variation in pond outlet in electrical conductivity.



**Figure 4: Line graphs for electrical conductivity and total sodium.**

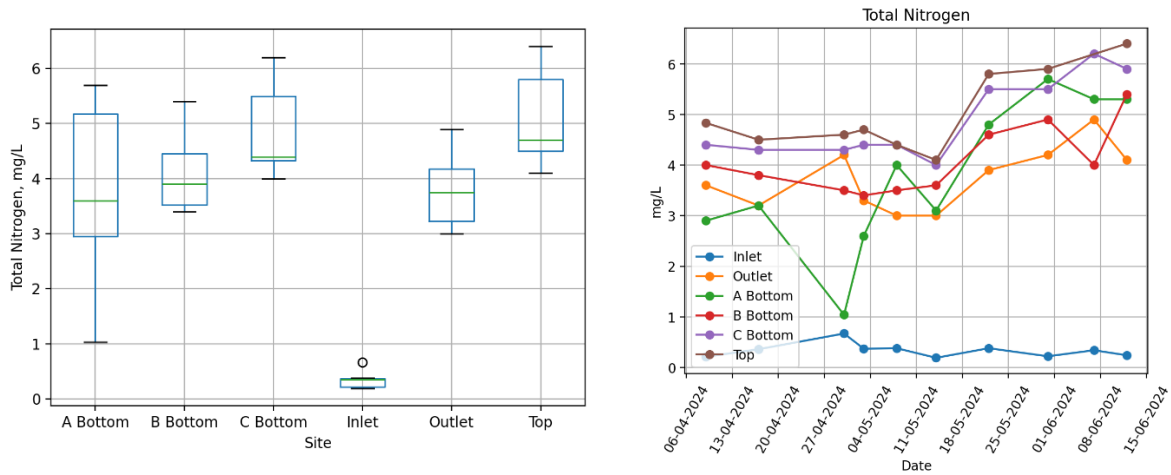
Overall, it is estimated that dilution through inflow into the pond is lower in this data set compared to the larger dataset previously reported on. However, the results support the use of electrical conductivity as a proxy for dilution. The assumptions and conclusions made in dilution assessment prepared in Memorandum 2 are supported by the results of this sampling (PDP, 2024).

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### 4.4 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/m<sup>3</sup>. The total nitrogen levels at the farm pond outlet ranged from 3.0 to 4.9 g/m<sup>3</sup>, which is consistent with the previously reported median concentration of 3.7 g/m<sup>3</sup>.



**Figure 5: Box and whisker plot of total nitrogen concentrations and results for individual sampling rounds.**

Based on the sampling results, the following observations have been made:

- ∴ Some TN removal was observed across all zones, although the removal efficiency varied.
- ∴ Zone A exhibited the highest TN removal, with median reduction of 24%, followed by Zones B and C with 17% and 6% median 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.

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- As noted above, flows in Zone C account for most of the total flow. Considering the 6% reduction in Zone C, the 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 higher levels of removal than is currently being achieved in Zone C. Good design and operation of the slopes will be key to achieving improved results.
- The median combined OLF slope and pond reduction in TN is 29%, which is consistent with the approximate 30% removal determined in Memorandum 2 (PDP, 2024).

### 4.5 Ammoniacal Nitrogen Performance

Median ammoniacal nitrogen levels in the treated wastewater discharge were higher in this sampling set than the larger data set used in Memorandum 2 (0.06 g/m<sup>3</sup> vs 0.03 g/m<sup>3</sup>).

Across the overland flow slope ammoniacal nitrogen levels dropped. Median concentrations at the bottom were 0.03 g/m<sup>3</sup> for Zone A and Zone B and 0.045 g/m<sup>3</sup> for Zone C. As for total nitrogen, this indicates that the ability of Zone C to nitrify ammoniacal nitrogen is inhibited by the observed higher flowrate and lower slope retention time.

At the farm pond outlet, the median ammoniacal nitrogen concentration was 0.10 g/m<sup>3</sup>. It is noted that the pond outlet median concentration is lower than the median concentration of 0.28 g/m<sup>3</sup> reported in Memorandum 2 (PDP, 2024).

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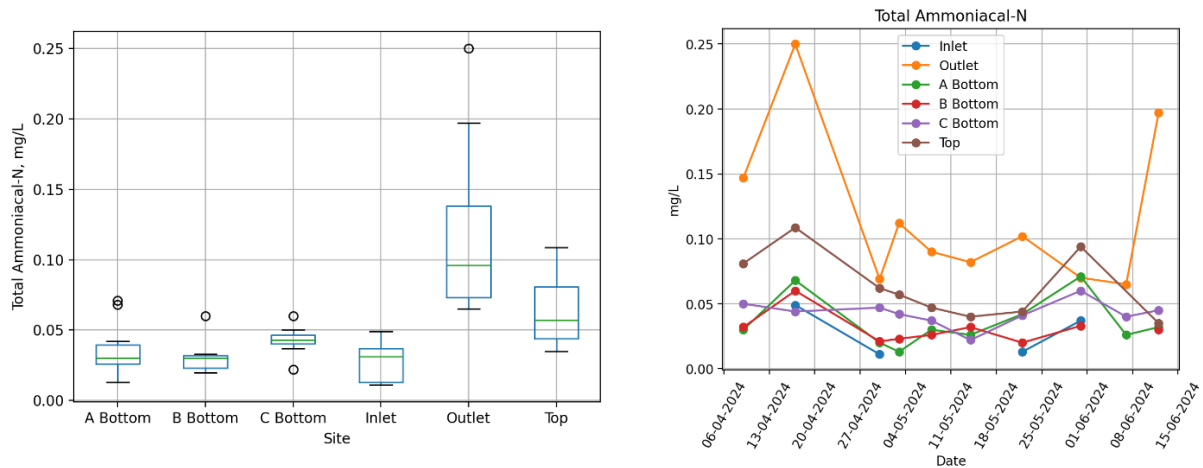


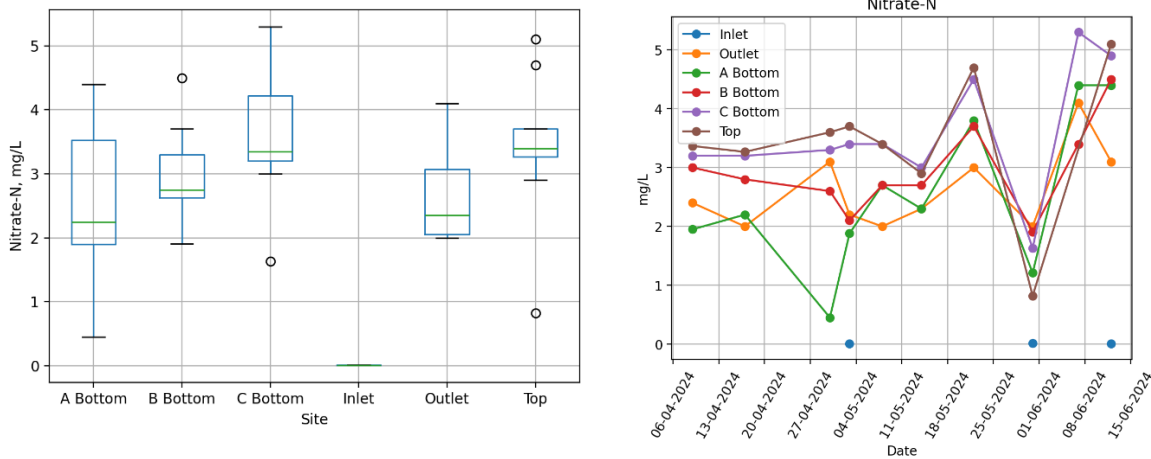
Figure 6: Ammoniacal Nitrogen Concentrations

Based on the sampling results, the following observations have been made:

- ∴ 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. Zone B demonstrated the highest median removal efficiency at 55%, followed by Zone A and Zone C at 36% and 26%, respectively. This general decrease in ammoniacal nitrogen across the OLF slope suggests that the existing setup adequately maintains aerobic conditions for the current treated wastewater flows and loads.
- ∴ The lower removal rate in Zone C is likely attributed to higher flow rates, steeper slopes, and greater channelisation, resulting in lower retention time on the OLF slope and thus lower treatment levels.
- ∴ There is an increase in ammoniacal nitrogen in the pond as was previously assumed in Memorandum 2. Over this sampling period the median ammoniacal nitrogen concentration increases 95% from the top of slope to the farm pond outlet. This is substantially lower than the nearly 900% increase previously reported in Memorandum 2. There were two detections above  $0.15 \text{ g/m}^3$  in the second and final rounds of sampling, however, at no point did values exceed the median of the previous data set ( $0.28 \text{ g/m}^3$ ).
- ∴ 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.
- ∴ It should be noted that this elevated ammoniacal nitrogen concentration did not persist in the downstream environment. Refer Memorandum 2 for details (PDP, 2024).

#### 4.6 Nitrate Performance

The nitrate levels in the treated wastewater discharge were generally lower than previously reported, ranging from  $0.82$  to  $5.1 \text{ g/m}^3$  with a median concentration of  $3.4 \text{ g/m}^3$ , compared to the previously reported median of  $5.02 \text{ g/m}^3$ . At the farm pond outlet, the nitrate levels were also slightly lower, with a median concentration of  $2.3 \text{ g/m}^3$ , compared to the previously reported median concentration of  $2.7 \text{ g/m}^3$ .

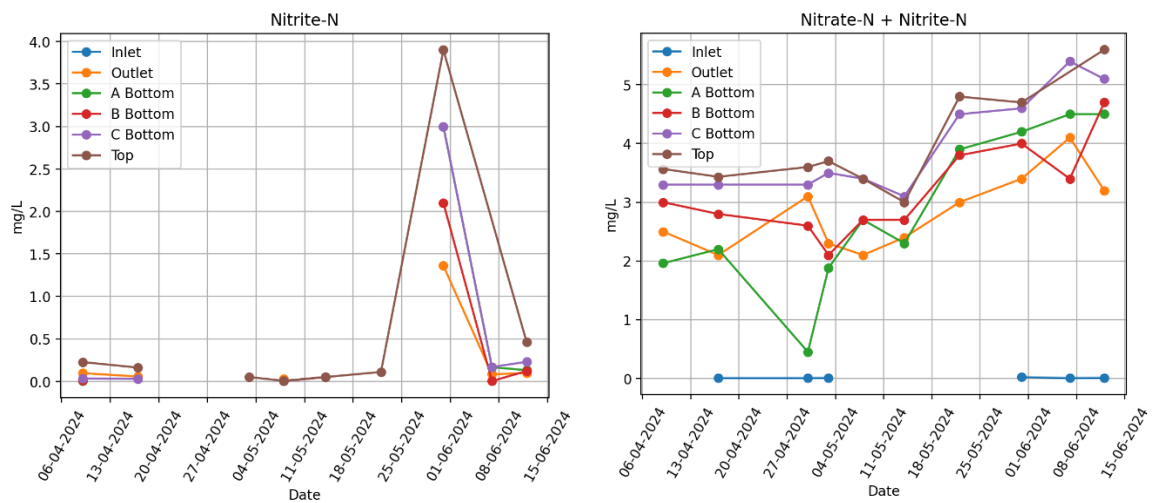


**Figure 7: Nitrate Concentrations**

Based on the sampling results, the following observations have been made:

- ∴ Similar to the TN results, Zone A exhibited the highest nitrate removal, with a median of 21%, followed by Zone B with 14% 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 results indicate the pond is still the primary means of nitrate removal. However, the higher levels of removal in Zones A and B indicate the potential for achieving higher levels of removal through improved wastewater dispersion and improvements to the grade of the slopes. Good design and operation of the slopes will be key to achieving improved results.
- ∴ The combined OLF slope and pond provided a median 36% reduction in nitrate, which is consistent with the 36% previously reported in Memorandum 2.
- ∴ It is noted that the results from sampling round 8 are an outlier and has been excluded from the assessments above. In this sampling round the nitrite nitrogen concentrations were significantly higher than usual. The total nitrite + nitrate nitrogen (NNN) concentration was consistent with the other sampling rounds before and after. It is assumed that a process upset in the WWTP resulted in an incomplete nitrification process. Nitrite and NNN concentrations are plotted below in Figure 8 for reference.

While this is an exception, it is noted that there was a high concentration of nitrite being discharged to the overland flow system. We see that the nitrite is removed (converted to nitrate) effectively both on the overland flow slopes and within in the pond. Nitrite was not detected at the base of Zone A indicating that a slope with a lower flowrate and a longer residence time can be effective at converting any residual nitrite in the WWTP effluent.

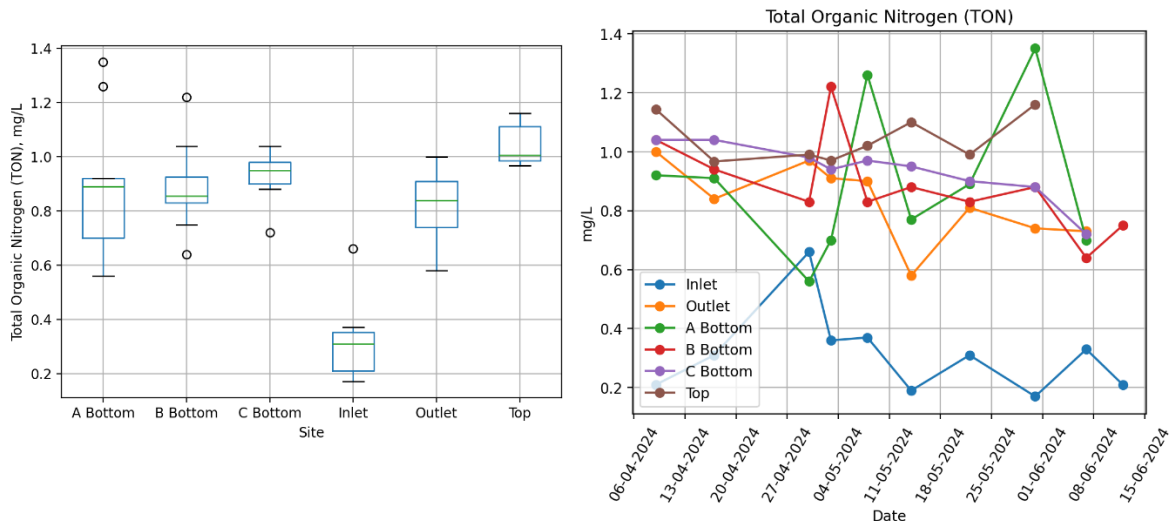


**Figure 8: Nitrite Nitrogen and Nitrite + Nitrate Nitrogen Sampling Results (non-detects not plotted)**

### 4.7 Organic Nitrogen

Organic nitrogen concentrations were not reported on in the interim assessment. Over the full sampling period, the median concentration in the WWTP effluent was 1.01 g/m<sup>3</sup>. At the farm pond outlet, the median concentration was 0.87 g/m<sup>3</sup>. Organic concentrations across the system are presented below in Figure 8.

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**Figure 9: Total Organic Nitrogen Sampling Results (non-detects not plotted)**

Based on the sampling results, the following observations have been made:

- ∴ As per other nitrogen species, the concentrations of organic nitrogen generally reduced across the system. The median reduction in concentration across Zones A, B and C was 15%, 16%, and 7% respectively. From the top of slope to pond outlet, there was a 13% reduction in organic nitrogen.
- ∴ The change in organic nitrogen concentration in zone A was highly variable. This is likely to due to the frequent low discharge flows observed in Zone A which at times made it difficult to collect samples without disturbing sediment or plant matter in the shallow discharge.
- ∴ Zone C had the lowest removal which is likely due to the higher discharge rate and reduced slope retention time.
- ∴ Considering the majority of wastewater is discharged to Zone C, the results indicate that the pond still has a large impact on organic nitrogen removal. However, in contrast to nitrate nitrogen, the overland flow slopes provided >50% of the total observed reduction in organic nitrogen.
- ∴ Higher reduction rates in Zones A and B indicate that greater removal rates can be achieved with lower application rates and longer retention times.

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### 4.8 Total Phosphorus Performance

Total phosphorus (TP) levels in the treated wastewater discharge were lower than previously reported, with a median concentration of 0.35 g/m<sup>3</sup> compared to a median of 0.87 g/m<sup>3</sup> reported in Memorandum 2 (PDP, 2024).

Similarly, TP levels at the farm pond outlet were lower than previously reported, with a median 0.27 g/m<sup>3</sup> compared to the previously reported median concentration of 0.47 g/m<sup>3</sup>.

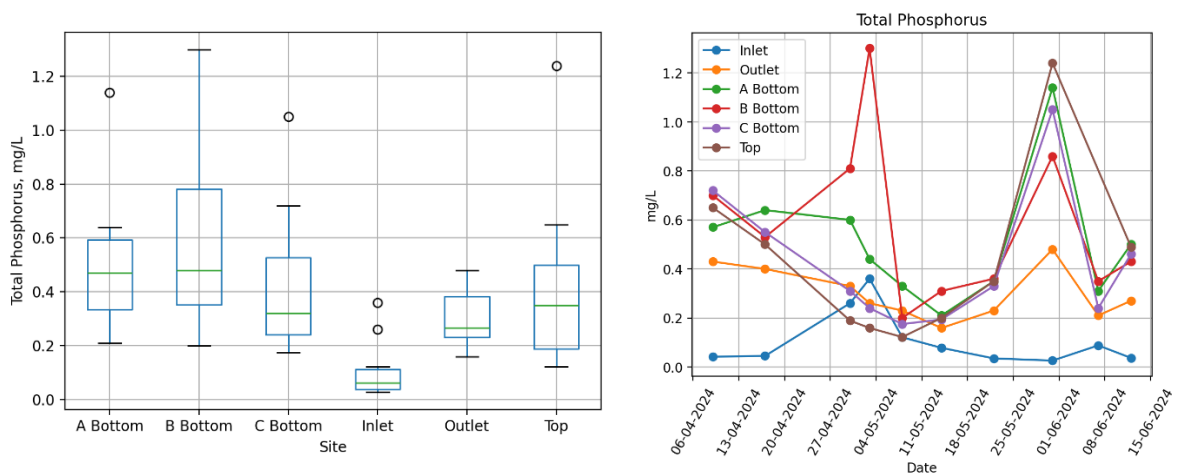


Figure 10: Total Phosphorus Concentrations

Based on the sampling results, the following observations have been made:

- ∴ There were generally increases in TP levels across all zones. The median increases for Zone A, B and C respectively were 17%, 7% and 10%.
- ∴ There was a large variety of TP concentrations recorded which appear to be primarily driven by changing concentrations in the effluent wastewater rather than environmental factors.
- ∴ Increases in TP is likely associated with an increase in suspended sediment as the treated wastewater flows down the OLF slope, as evidenced by the increase in turbidity across the slope areas (See Appendix A).
- ∴ There may also be an equilibrium between phosphorus in the wastewater and in the surface soils. In sampling round 8, when phosphorus concentrations were much higher than usual, there were reductions across the overland flow slopes in both TP and DRP. This could indicate that some phosphorus was adsorbing on the overland flow slope. Since concentrations in the effluent are generally lower than the longer-term data set used in Memorandum 2 (0.35 g/m<sup>3</sup> vs. 0.87 g/m<sup>3</sup>), the overall increase in phosphorus concentrations across the overland flow slopes

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could be as a result of phosphorus adsorbed at previous higher concentrations now desorbing while wastewater effluent concentrations are lower.

- ∴ Despite the fluctuations in WWTP effluent, pond outlet concentrations were relatively consistent over the ten sampling rounds. The pond appears to buffer wastewater flows and provides some dampening to fluctuating WWTP effluent. Overall, there was a median reduction in TP concentration over the combined overland flow/pond system of 20%. The pond is providing for the majority of the removal as well as compensating for increased TP concentrations at the base of the overland slopes.
- ∴ Note that the results for Zone B in round 4 have been excluded from this assessment. The sample was likely to have excessive TP due sediment collected sampling under low flow conditions. Similarly, the WWTP issue highlighted in the nitrate results above appears to also have affected phosphorus concentrations. Round 8 has been excluded from the removal efficiencies described above.

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### 4.9 Dissolved Reactive Phosphorus Performance

Apart from the sediment impacted samples described above, Dissolved Reactive Phosphorus (DRP) trends closely follow Total Phosphorus. DRP levels in the treated wastewater discharge were lower than previously reported, with a median concentration of 0.23 g/m<sup>3</sup> based on the lab results, compared to the previously reported median of 0.73 g/m<sup>3</sup>. At the farm pond outlet, DRP levels were also lower, with an average of 0.19 g/m<sup>3</sup> compared to the previously reported median concentration of 0.38 g/m<sup>3</sup>.

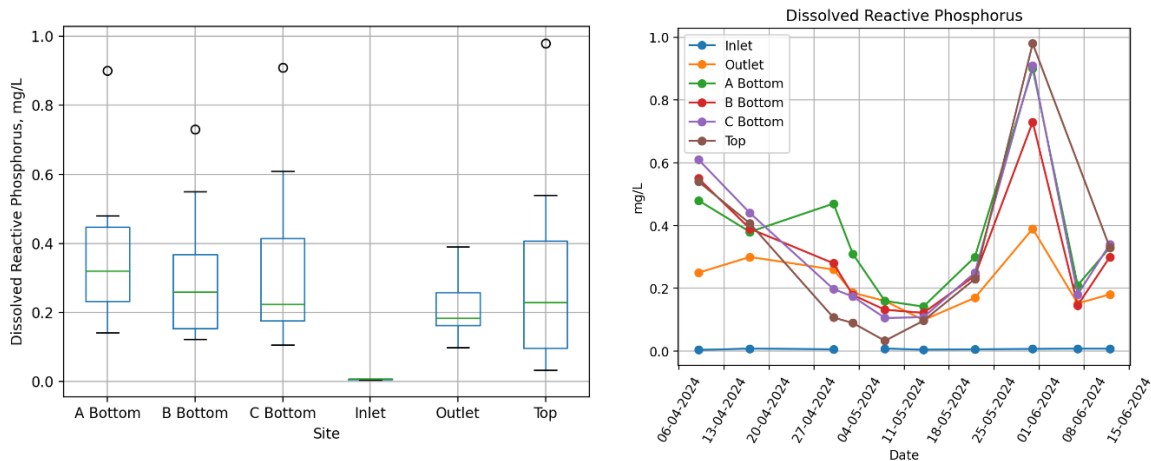


Figure 11: Dissolved Reactive Phosphorus Concentrations



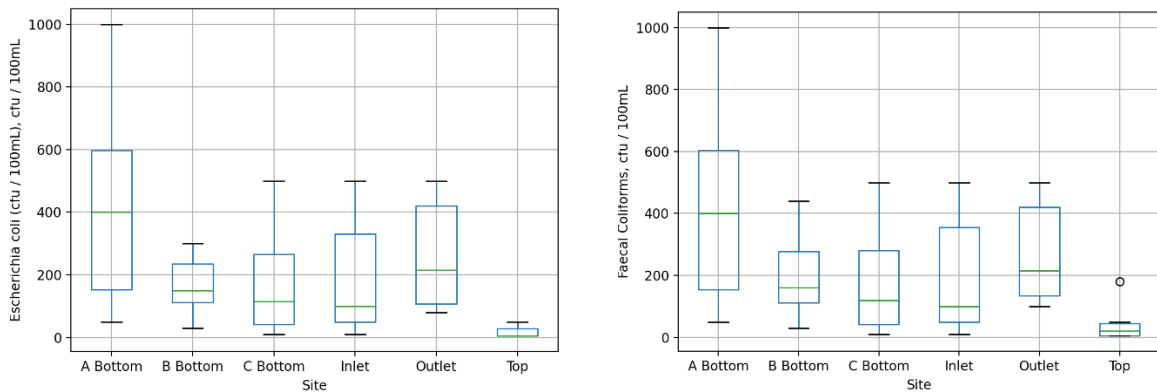
Based on the sampling results, the following observations have been made:

- ∴ Similar to the trend observed from TP removal performance, the treatment performance varied across the zones with increases of 30%, 4%, and 11% for Zones A, B, and C respectively.
- ∴ Similar to the pond outlet concentrations of TP, DRP outlet concentrations were relatively consistent, and changes reflected the fluctuating treated wastewater concentrations.
- ∴ As observed with the total phosphorus results, all the DRP removal was achieved in the pond. Overall, the combined slope/pond system achieved a median DRP reduction of 26%. This would indicate that the pond is providing approximately 35% reduction in DRP when allowing for an average increase across the slopes of 10%.

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#### 4.10 E. Coli and Faecal Coliforms

*E. Coli* and Faecal Coliform concentrations were generally similar throughout the sampling. The results across the slopes and pond are presented below in Figure 12. As predicted in PDP Memorandum 2, there are significant increases across the slopes and through the pond. *E. Coli* and Faecal Coliform concentrations are generally low in the treated wastewater with median concentrations of 5 and 20 cfu/100 mL respectively (PDP, 2024). At the pond outlet the median concentration for both was 250 cfu/100 mL.



**Figure 12: E. Coli and Faecal Coliform Box and Whisker Plots**

The median increase in concentration across the combined system was a 19-fold increase for both *E. Coli* and Faecal Coliforms. Based on the sampling results, it appears that the overland flow slopes are the primary contributor to increasing faecal contamination with approximately 2/3<sup>rd</sup>s of the total median increase occurring on the slopes.

It's likely that this faecal contamination is from environmental sources. For most of the sampling, it is assumed that the faecal matter is avian. However, in the eighth round of sampling there were signs (pugging, faecal matter) that cattle had been inside the overland flow area. This is likely to contribute to the increasing faecal load observed.

It is strongly recommended that cattle and other farm animals are prevented from accessing the overland flow area, either intentionally or unintentionally.

#### 4.11 Other Observations

The key observations and conclusions based on the available laboratory results are as follows:

- ∴ BOD levels were generally below the laboratory detection limit of 2 g/m<sup>3</sup> 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, fourth and sixth rounds of sampling, this was due to low wastewater flow in these zones, leading to disturbance and sediment pickup during sample collection.

PDP highlighted the risk of increasing BOD concentrations in Memorandum 2, however, no increase in BOD was detected. It appears that this risk is low with the slope grade and planting of the existing OLF.

- ∴ 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 has excellent clarity with turbidity <5 NTU on average.
- ∴ Chlorophyll-a levels were below the laboratory detection limit of 0.003 g/m<sup>3</sup> across all samples, except for the inlet in the first four sampling rounds. This indicates that there is not significant growth of algae except for the stagnant area near the pond inlet which returned slightly higher chlorophyll-a levels consistent with observations of algal growth during sampling. Due to the consistent results below the laboratory detection limit, testing for chlorophyll-a was discontinued for last six sampling rounds.
- ∴ 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 at the top of Zone A, B or C.

## 5.0 Summary

Based on the sampling results obtained, the following general conclusions have been drawn:

- ∴ Concentrations of sodium and chloride as well as electrical conductivity are consistent across all sampling locations except for the pond inlet. This indicates that flows out of the farm pond are almost entirely wastewater over the sampling period. Considering this, previous assumptions (Memorandum 2) about negligible change in electrical conductivity (other than due to dilution) through the system are likely correct.
- ∴ The overland flow system, excluding the pond, provides additional removal for a variety of nitrogen species including ammoniacal nitrogen (26%-55%), nitrate nitrogen (4%-21%), organic nitrogen (7%-16%). Overall, the overland flow slope total nitrogen removal efficiency ranged from 6% to 24%. These removal rates are based on the median removal rates for each of the three zones within existing overland flow system.  
  
Despite these removal rates, the results demonstrate that, under the current system, the pond provides most of the system nitrogen removal. Most wastewater flows through Zone C which consistently produced the lowest nitrogen removal results; median total nitrogen removal for Zone C was 6%. Comparatively, the combined slope/pond system resulted in a median nitrogen reduction of 29% from the top of slope to the farm pond outlet.
- ∴ During the sampling period, phosphorus concentrations typically increased from the top to bottom of the OLF slopes. The largest increases were seen when wastewater flows were low, resulting in longer retention times. It is thought that phosphorus concentration the surface soils are in equilibrium with phosphorus concentrations in the wastewater. During the sampling period, the median total phosphorus concentration was only 40% of the long-term median. As a result of the decreased wastewater concentration, it is likely that phosphorus is desorbing from the surface soils. If phosphorus concentrations increased, it is possible that the equilibrium would shift and phosphorus in the wastewater would adsorb to the surface soils. The OLF slopes may inhibit gains from future WWTP upgrades targeting greater phosphorus removal until a new equilibrium is reached.

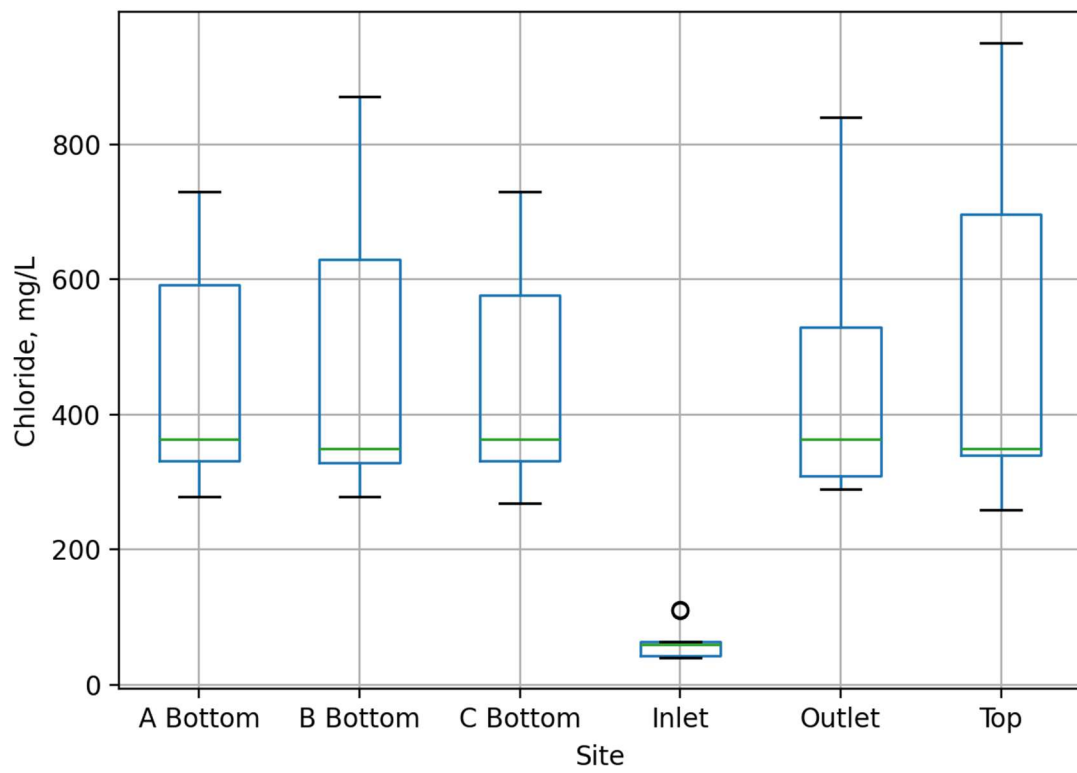
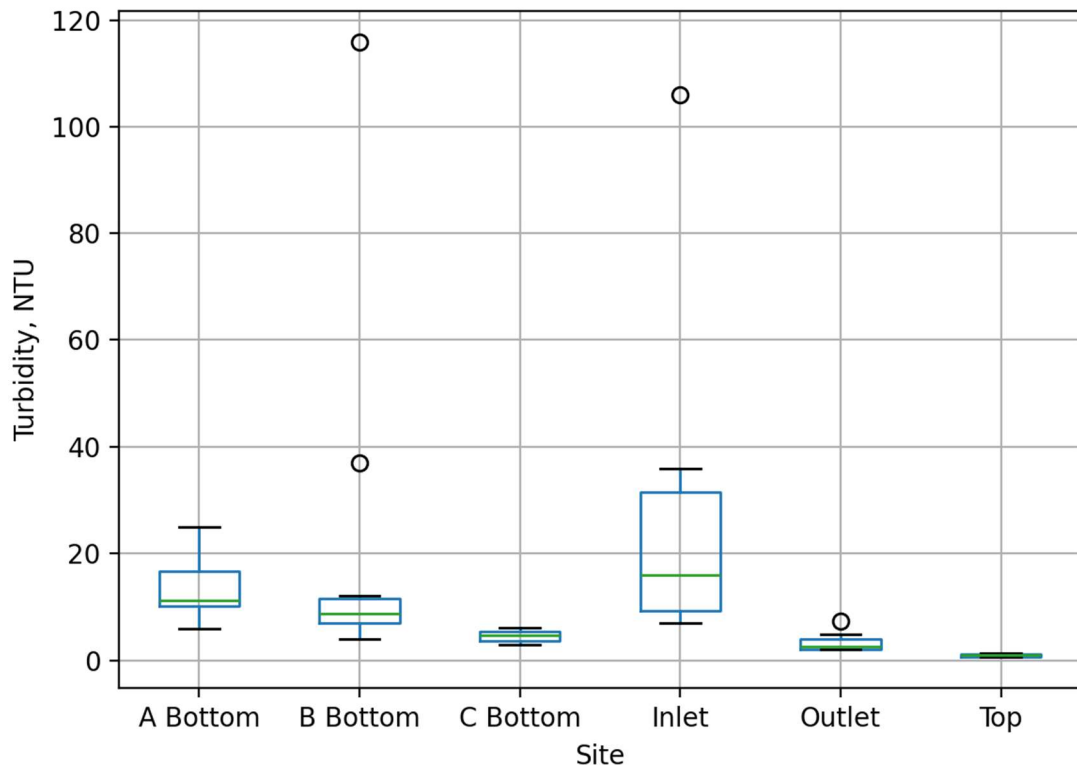
For the sampling period, the total removal across the slope/pond system was 20% and 26% for total phosphorus and dissolved reactive phosphorus respectively. Allowing for a 10% increase across the overland flow slopes, this indicates that the pond is providing removal rates of approximately 30% of the applied wastewater concentration for total phosphorus and 36% for dissolved reactive phosphorus.

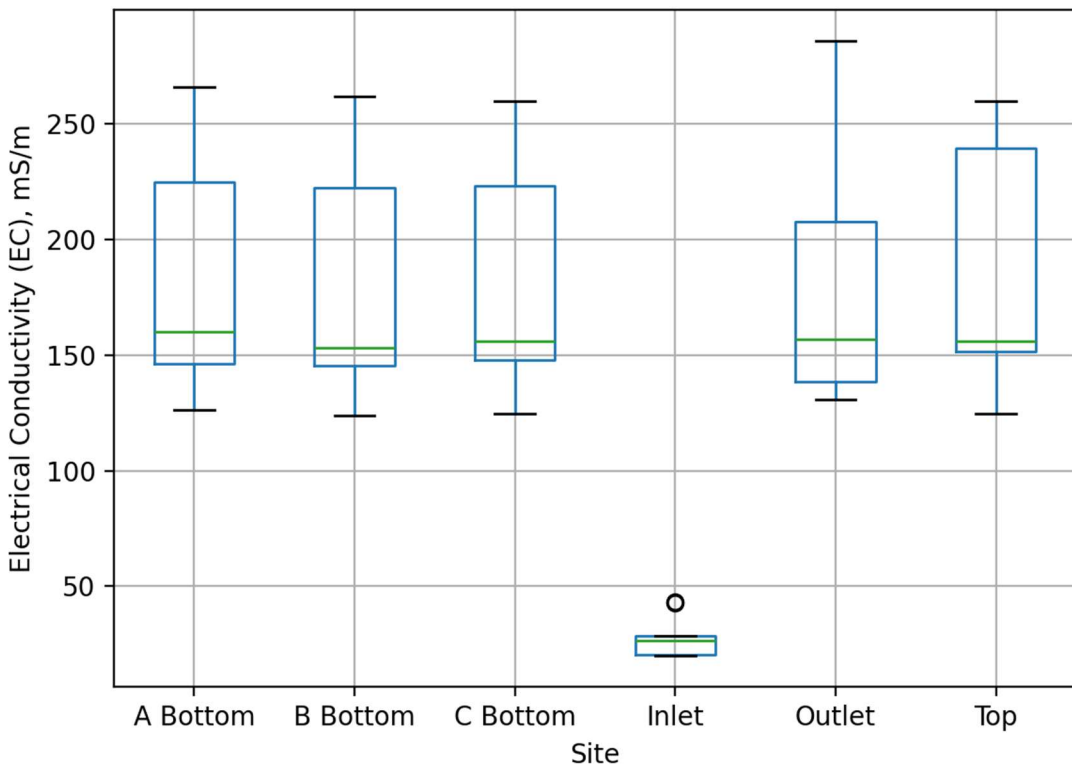
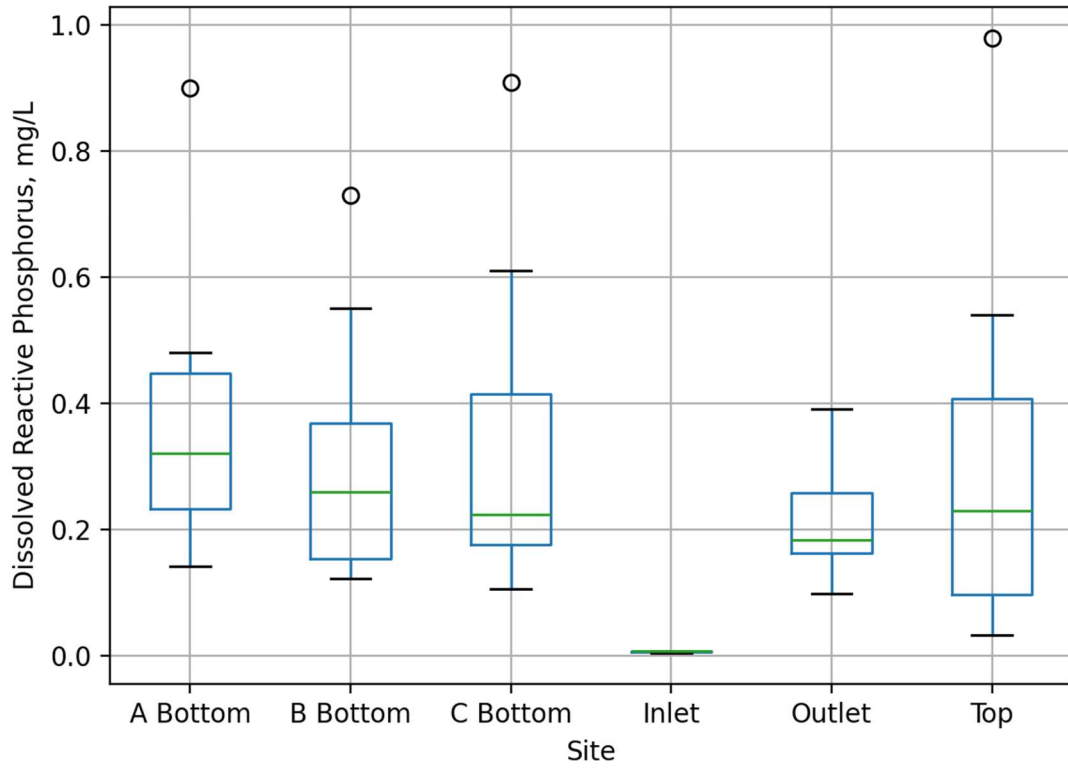
- ∴ Based on the field observations made over the sampling and the results described in this report, it is clear the uneven and inconsistent nature of the dispersion system is reducing the level of treatment provided by the overland flow slopes. The absence of gentle, well graded slopes and rapid concentration/channelisation of wastewater within Zones B and C is reducing the nitrogen attenuation capacity 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.
- ∴ Despite good performance observed for specific contaminants in Zones A and B, the performance investigation shows that the pond provides the majority of treatment for key contaminants including total nitrogen, nitrate-nitrogen, total phosphorus and dissolved reactive phosphorus.
- ∴ Conversely, ammoniacal-nitrogen concentrations generally decrease over the overland flow slopes before 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, and in select instances from cattle accessing the overland flow area. Generally, faecal coliform counts were consistent with those detected in the upstream catchment.

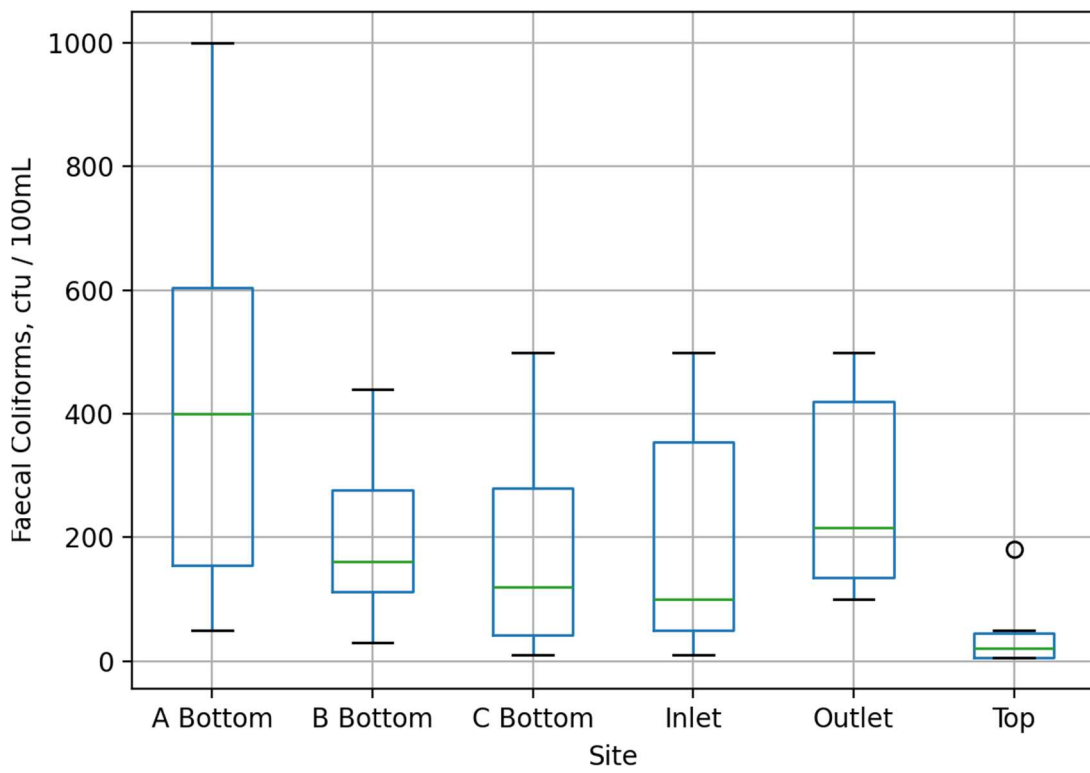
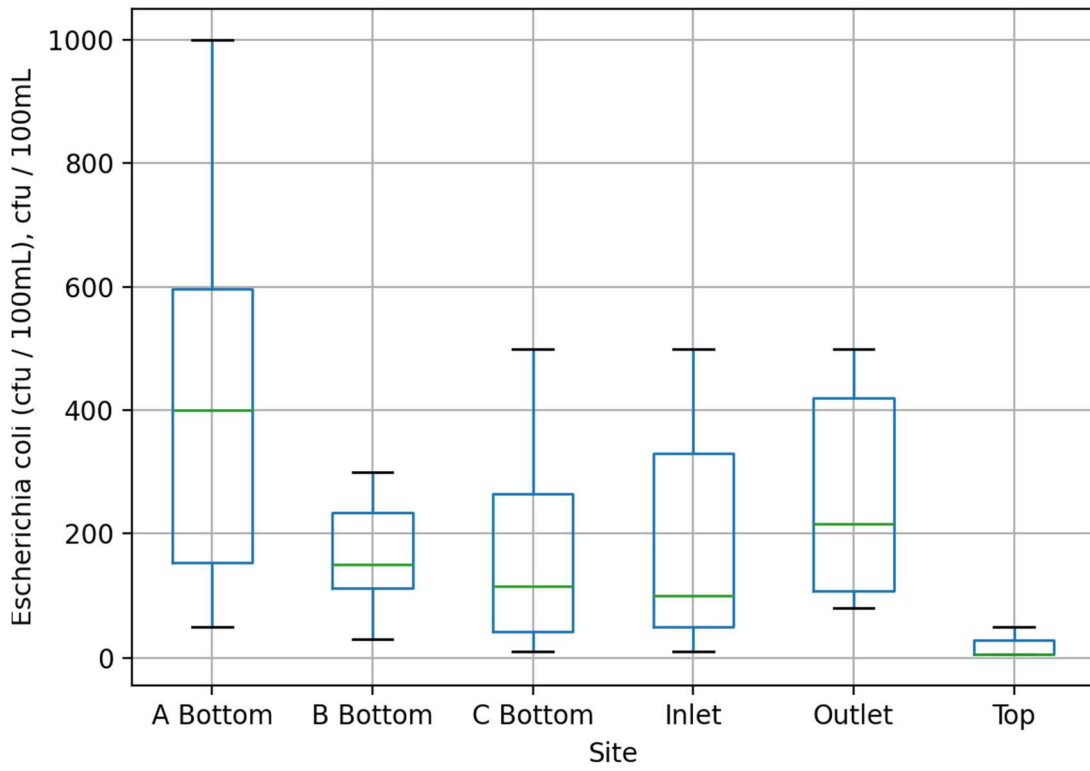
**Generally, the sampling completed confirms the assumptions made and anticipated results previously set out in PDP Memorandum 2.** However, as highlighted in Memorandum 2, the pond currently appears to provide the majority of additional treatment. Improvement to the distribution system and better preparation of the overland flow slopes to avoid rapid concentration of wastewater may improve the performance of the overland flow slopes in the future.

## Appendix A: Graphical Results

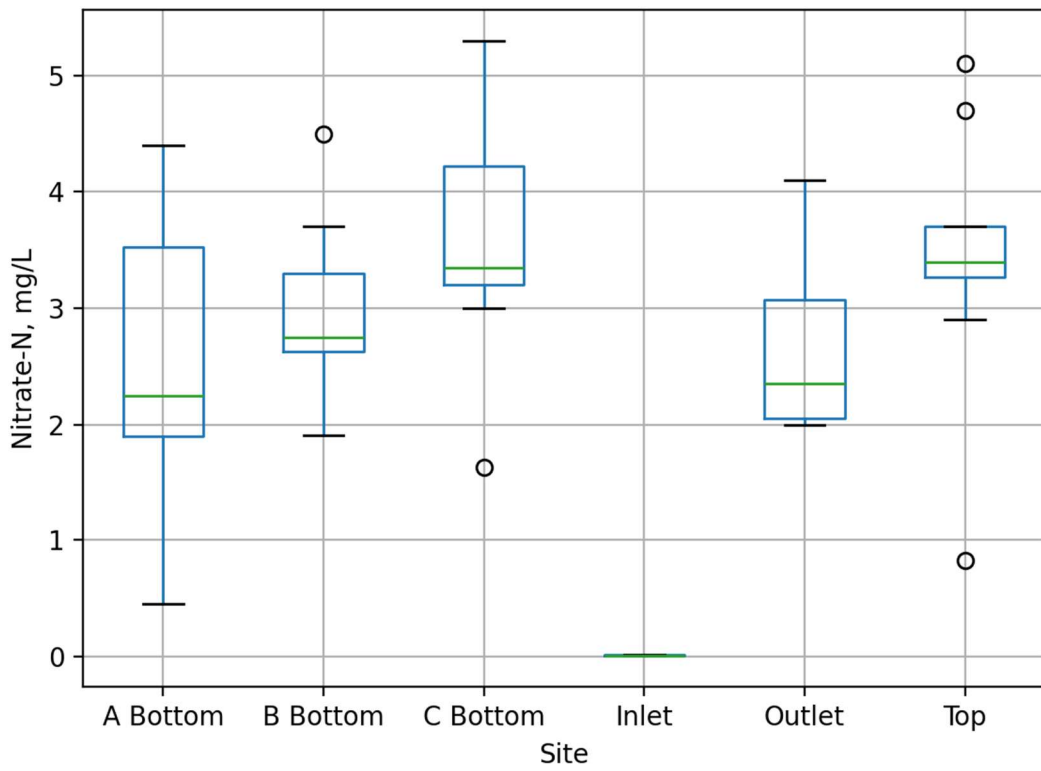
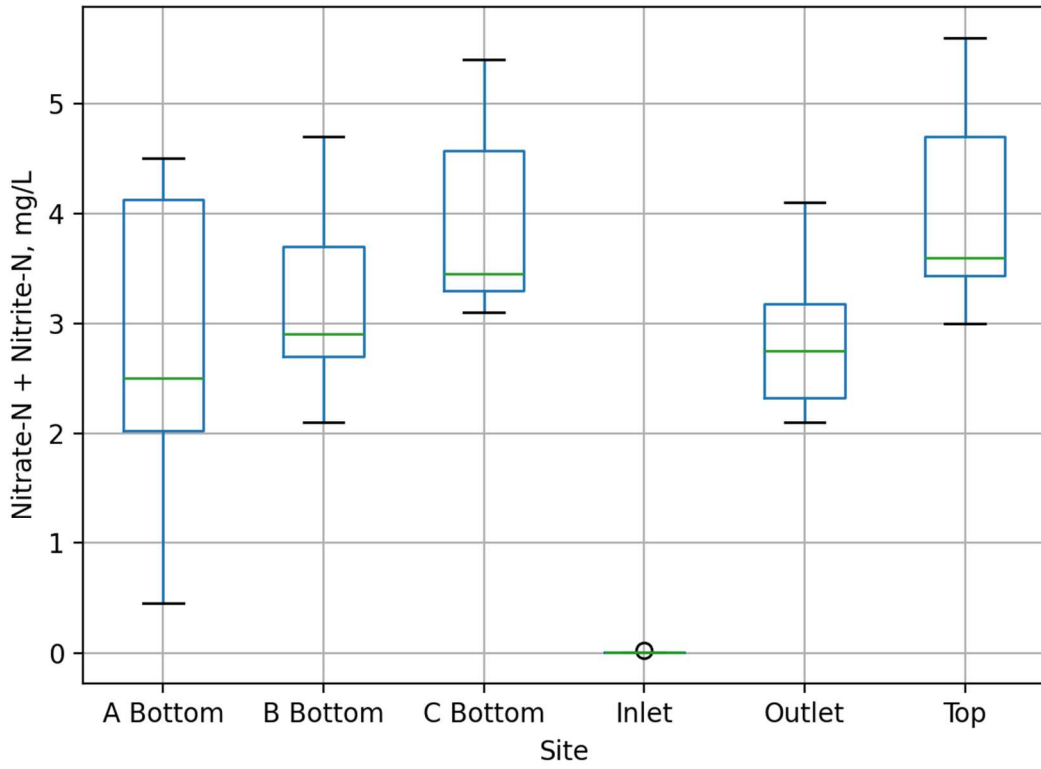
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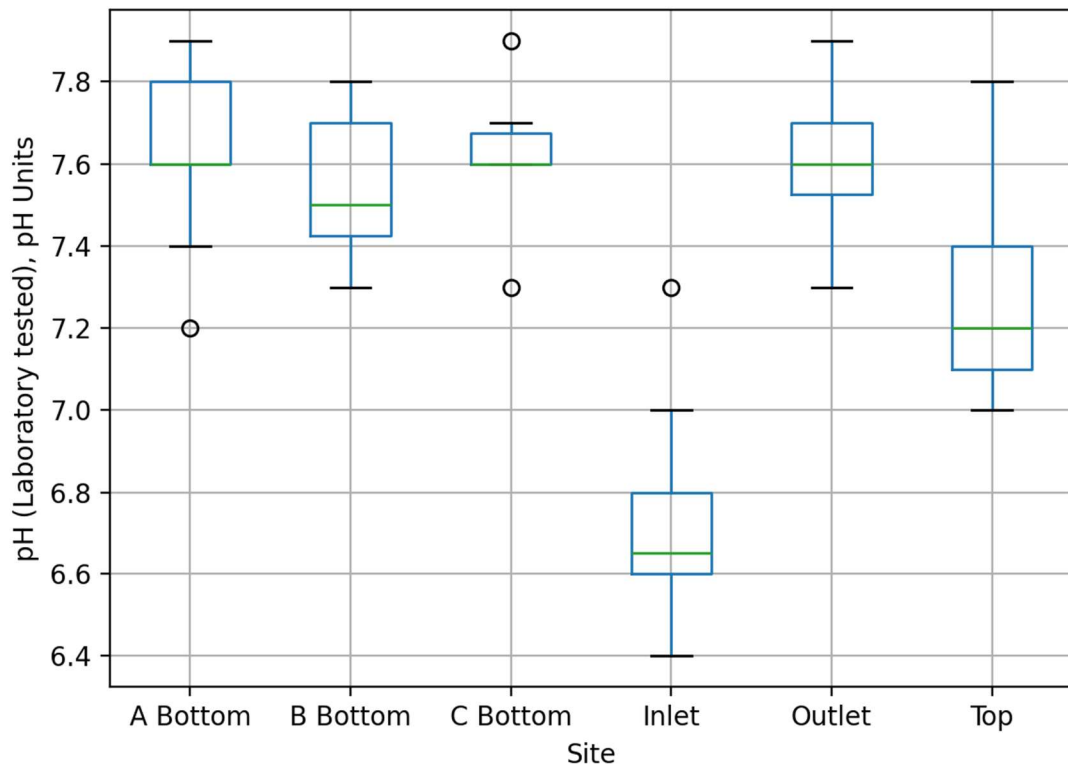
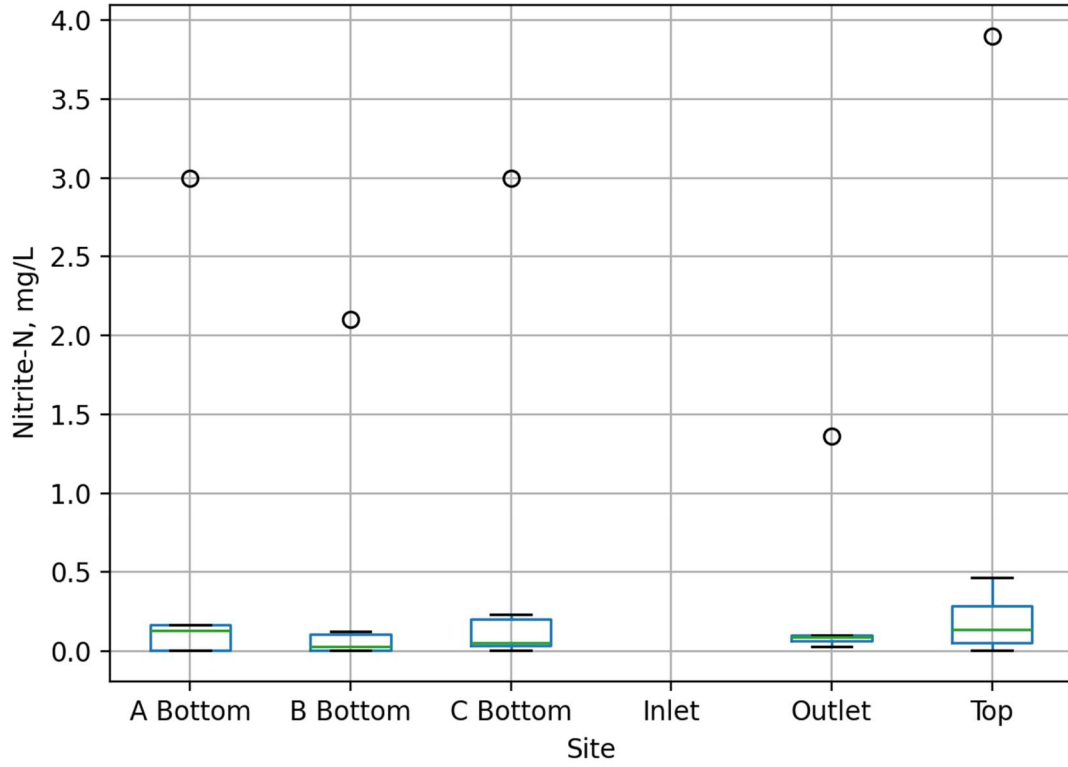


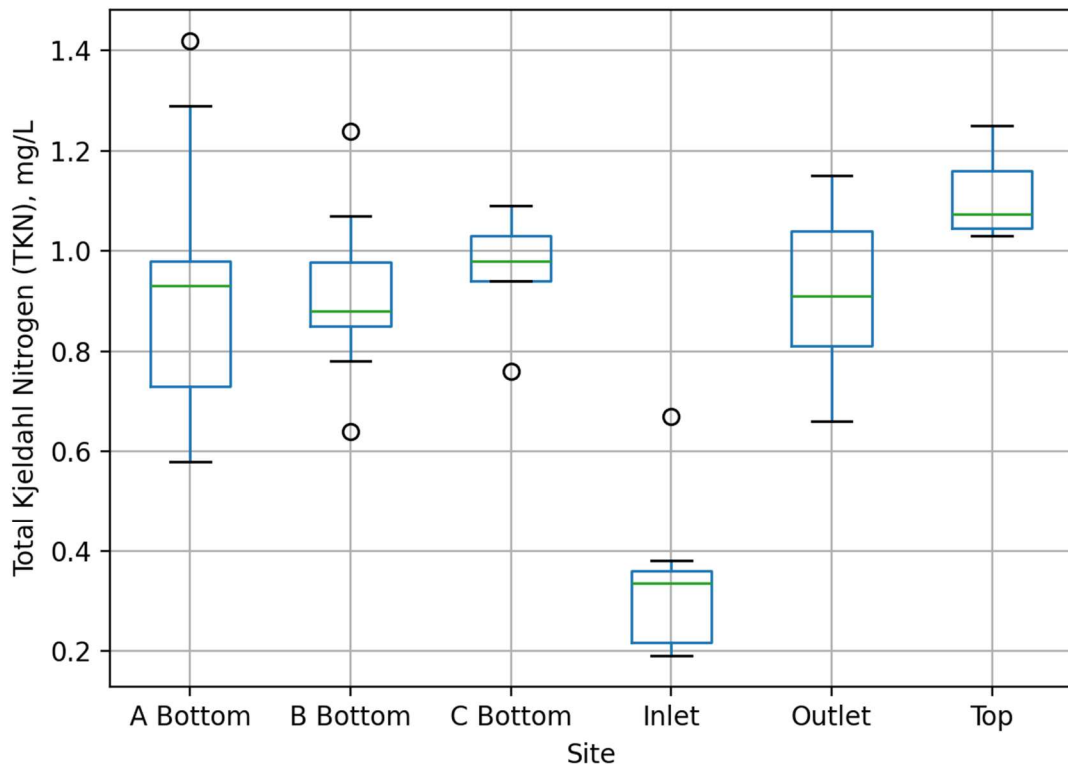
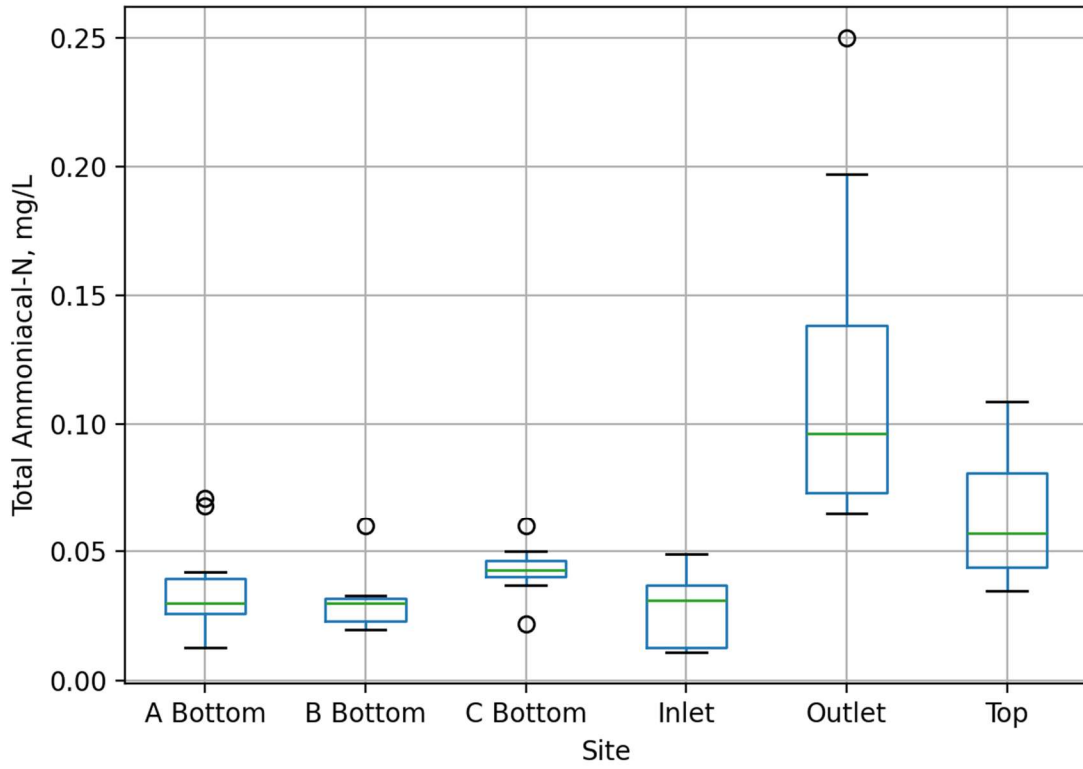


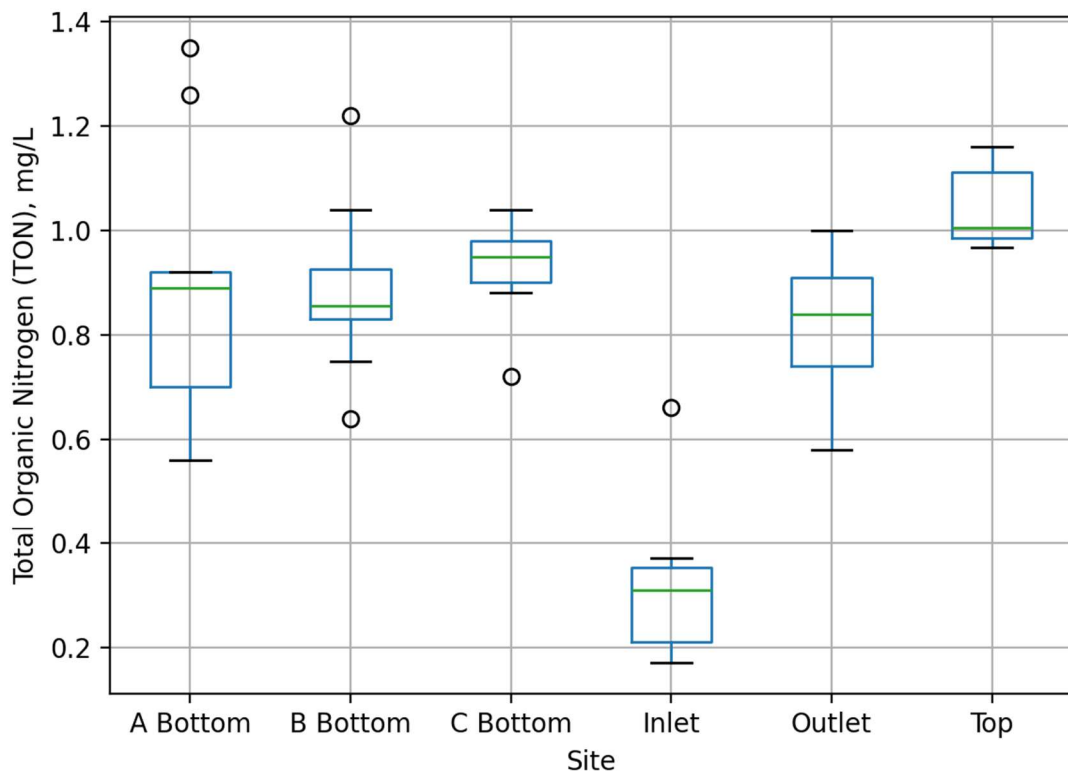
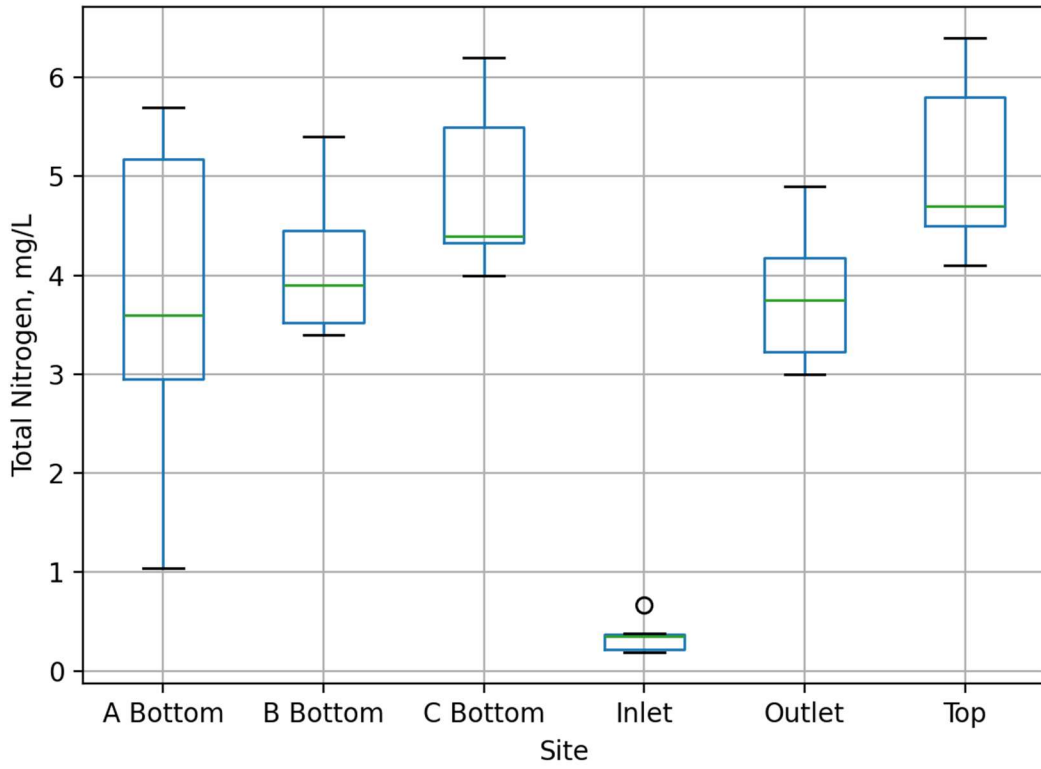


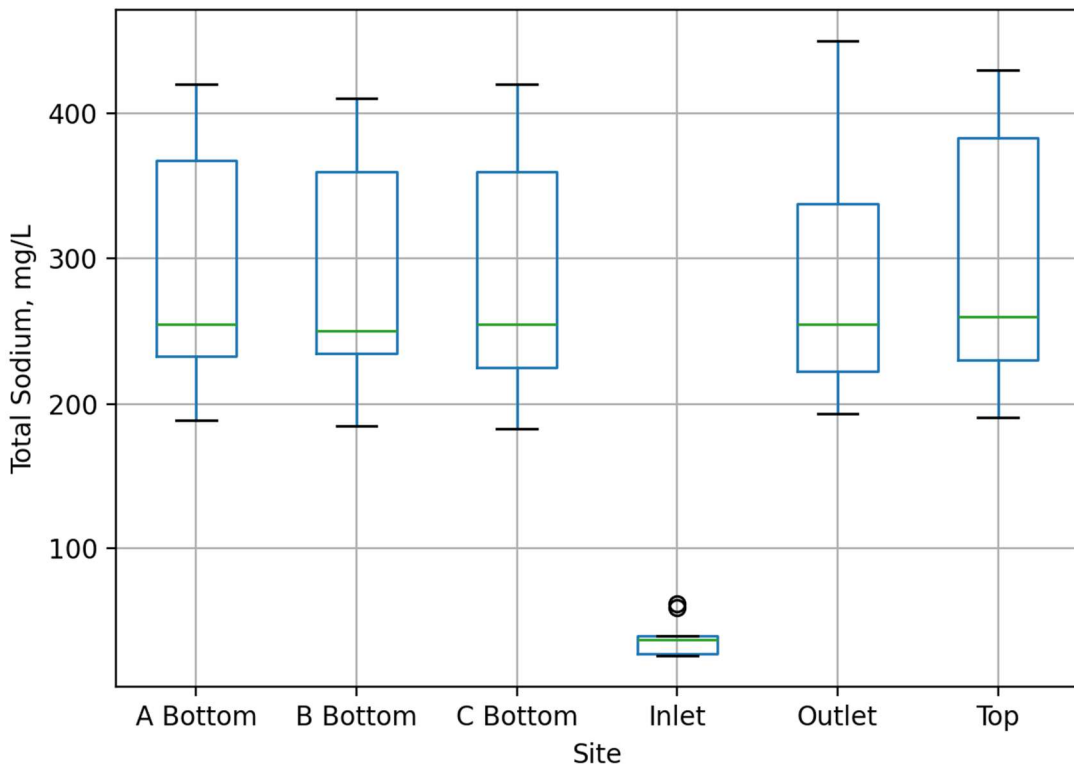
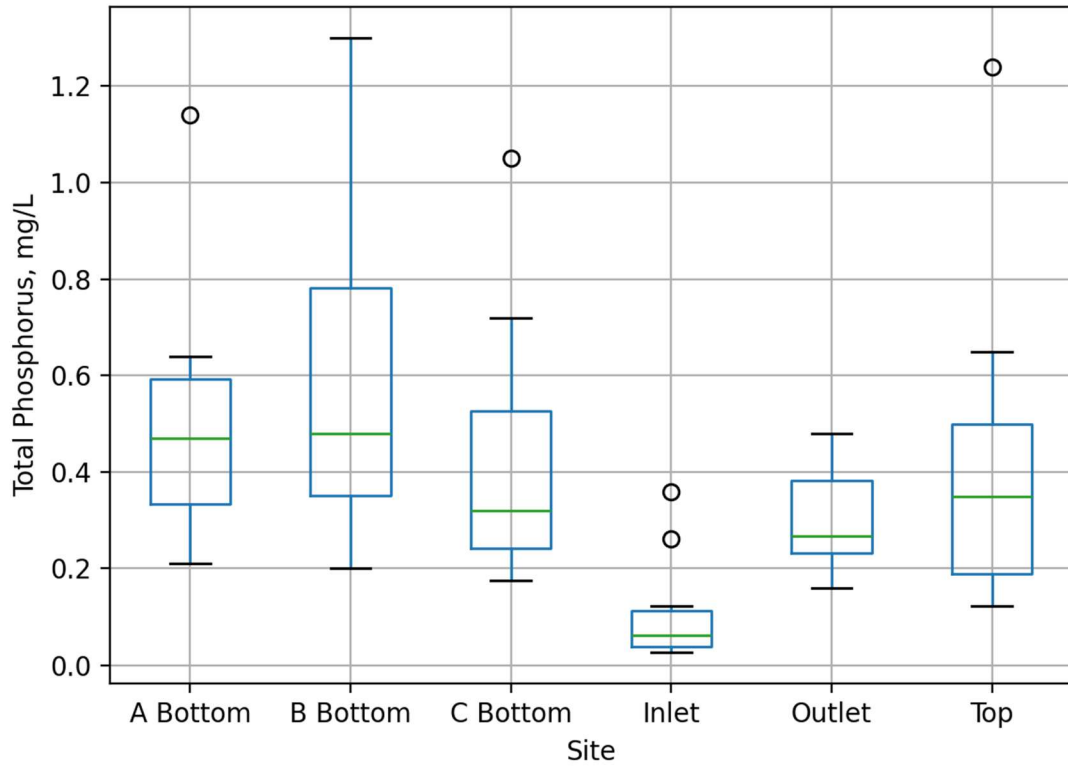


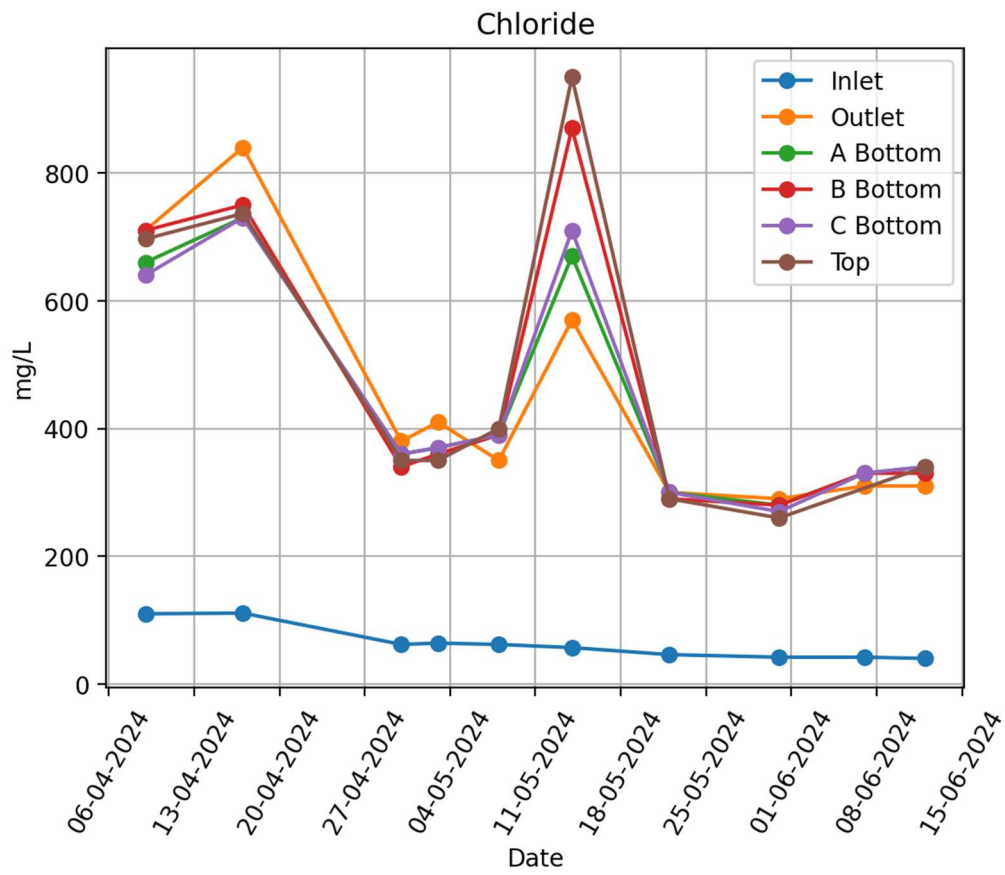
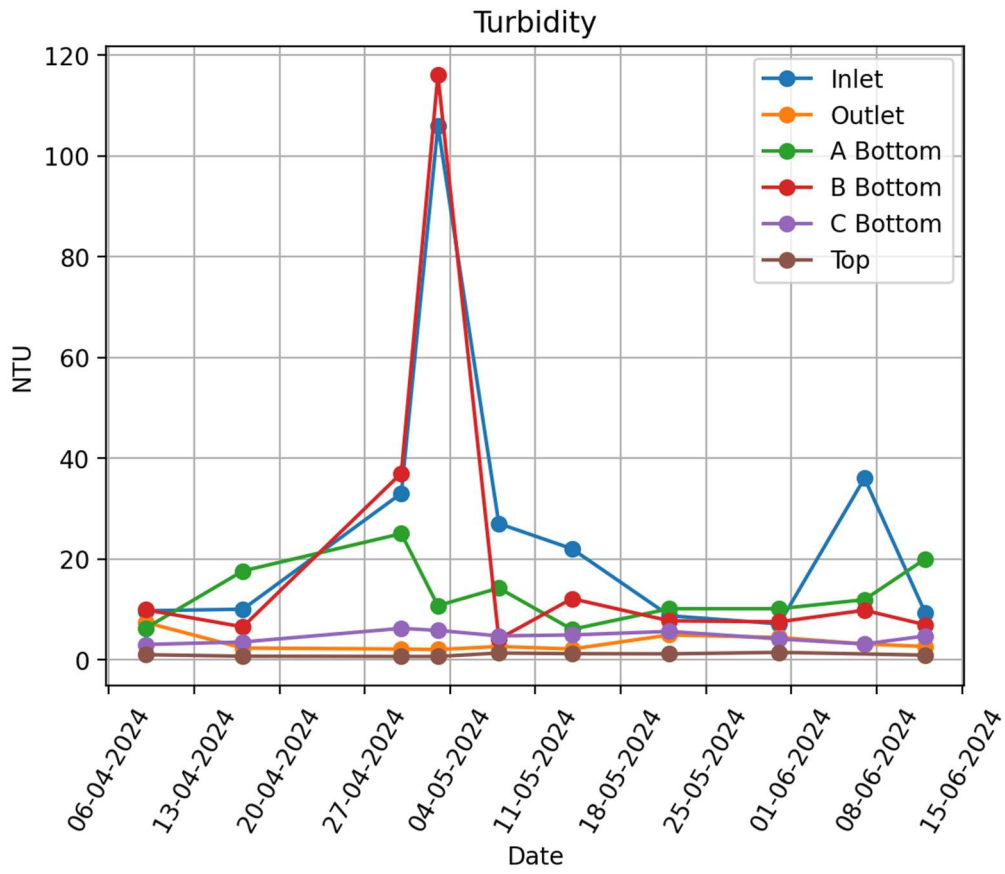




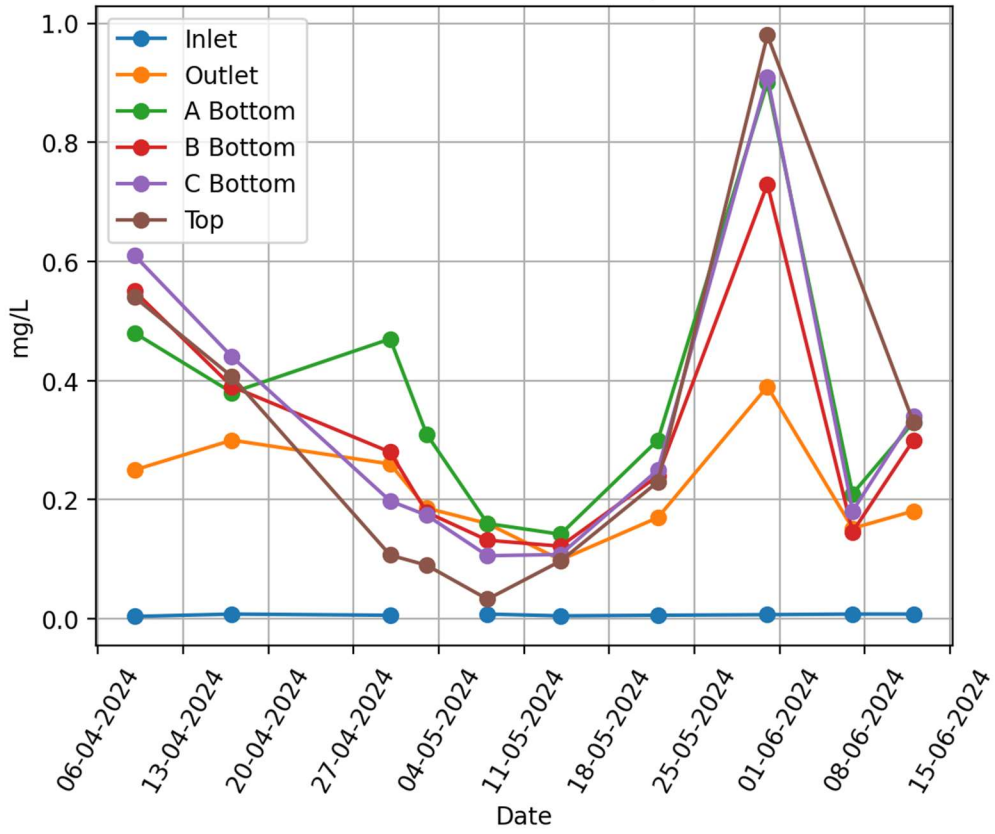




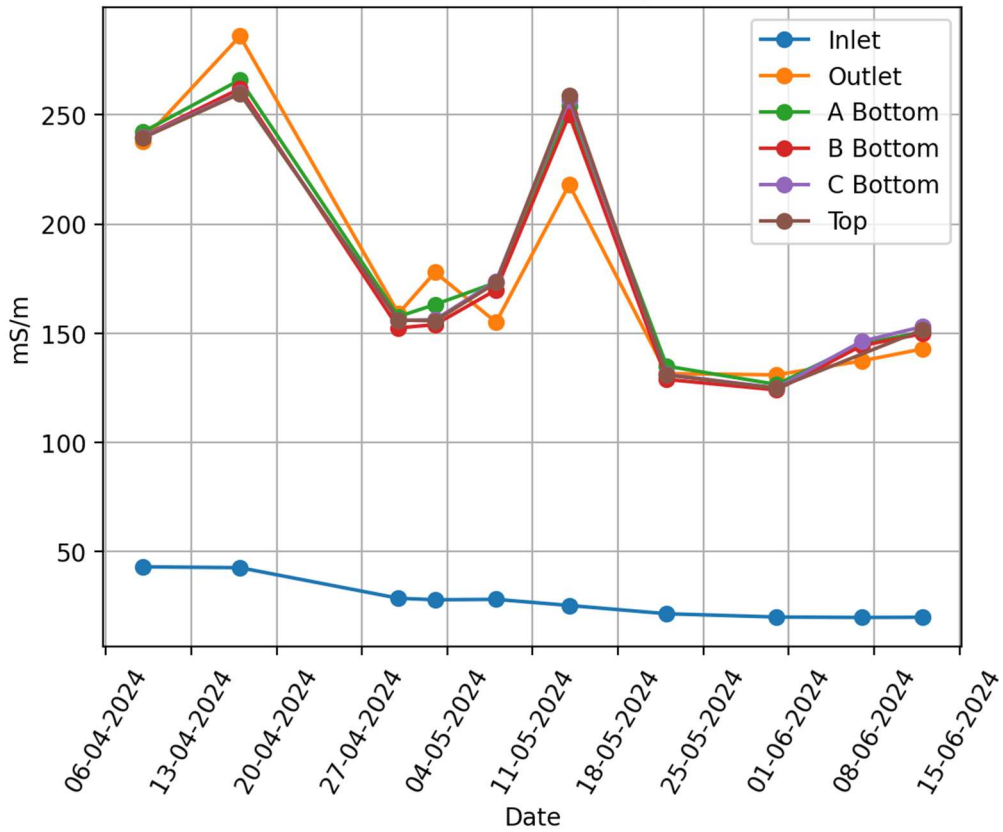


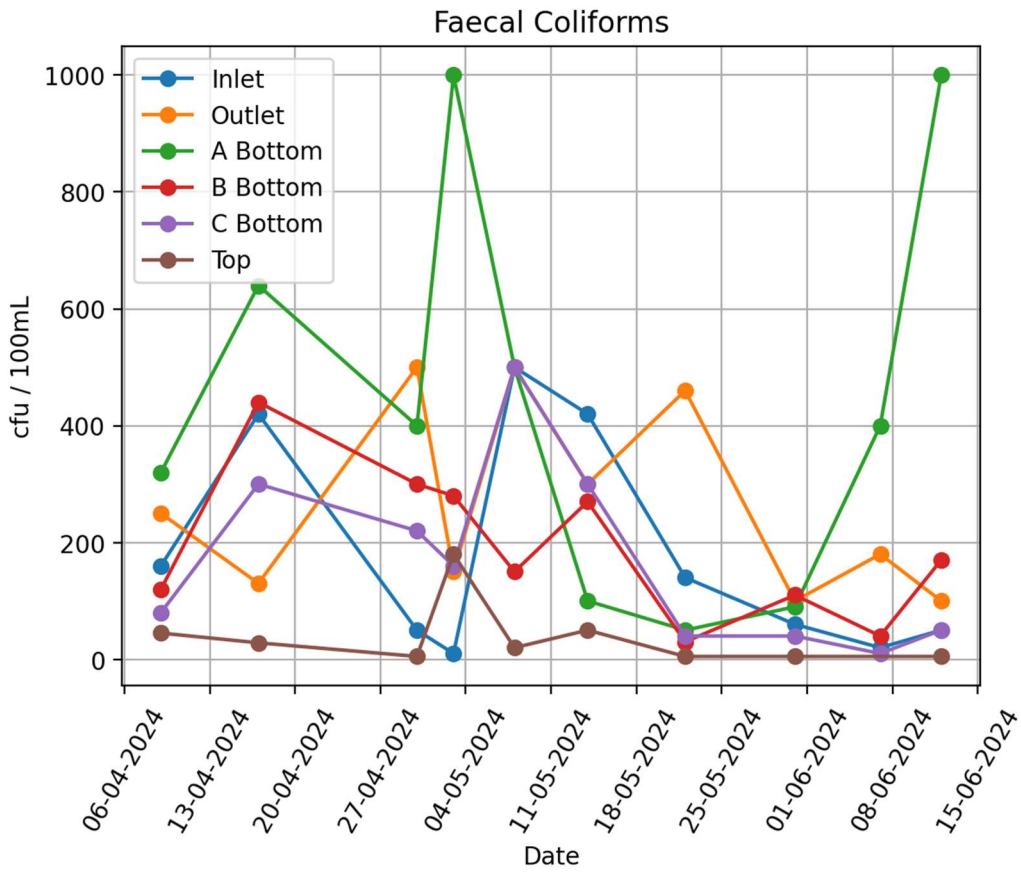
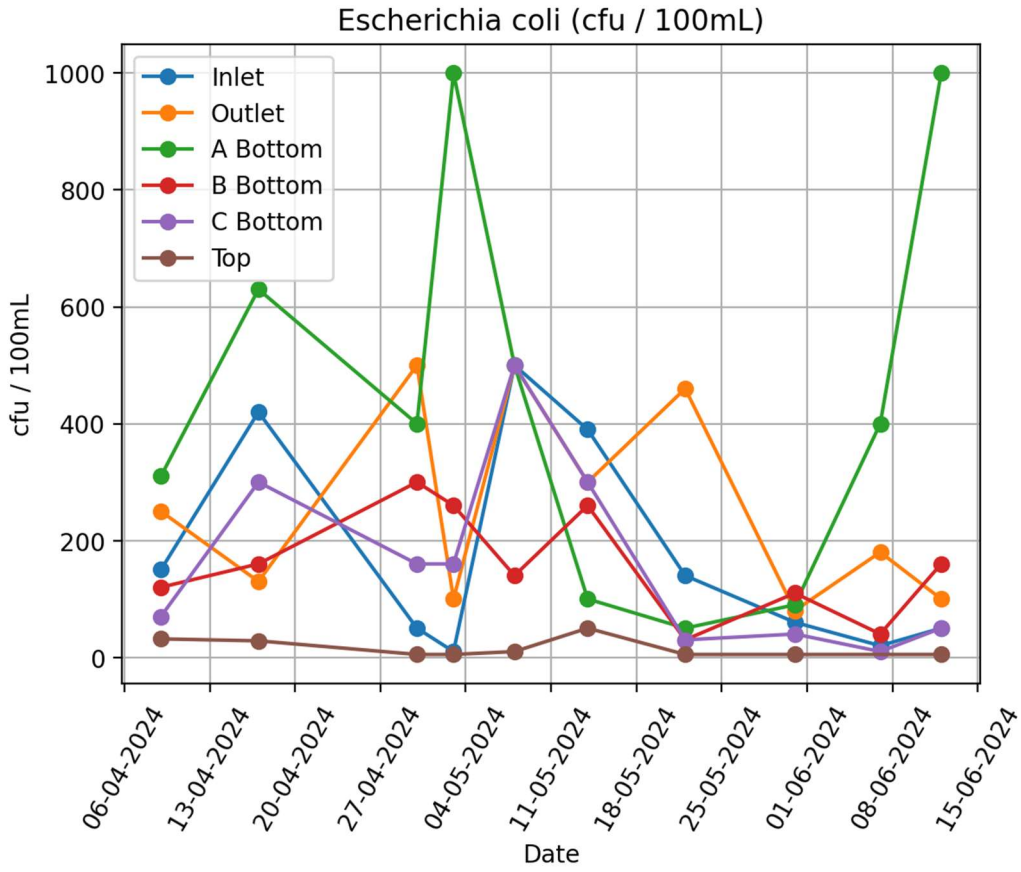


### Dissolved Reactive Phosphorus



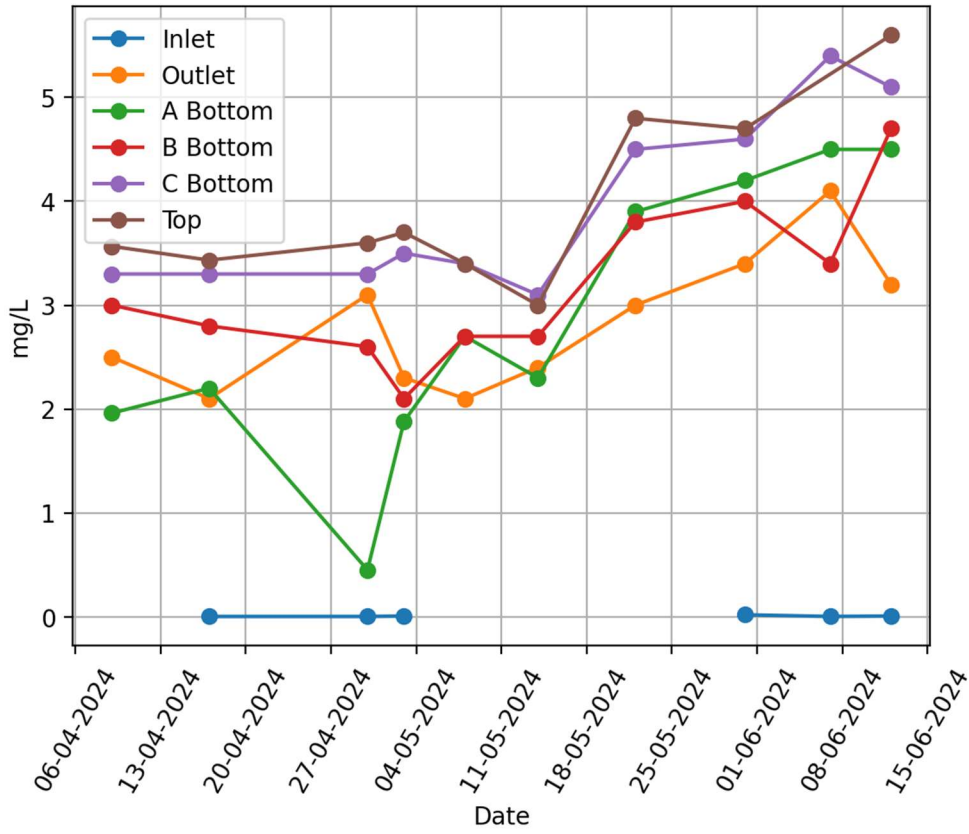
### Electrical Conductivity (EC)



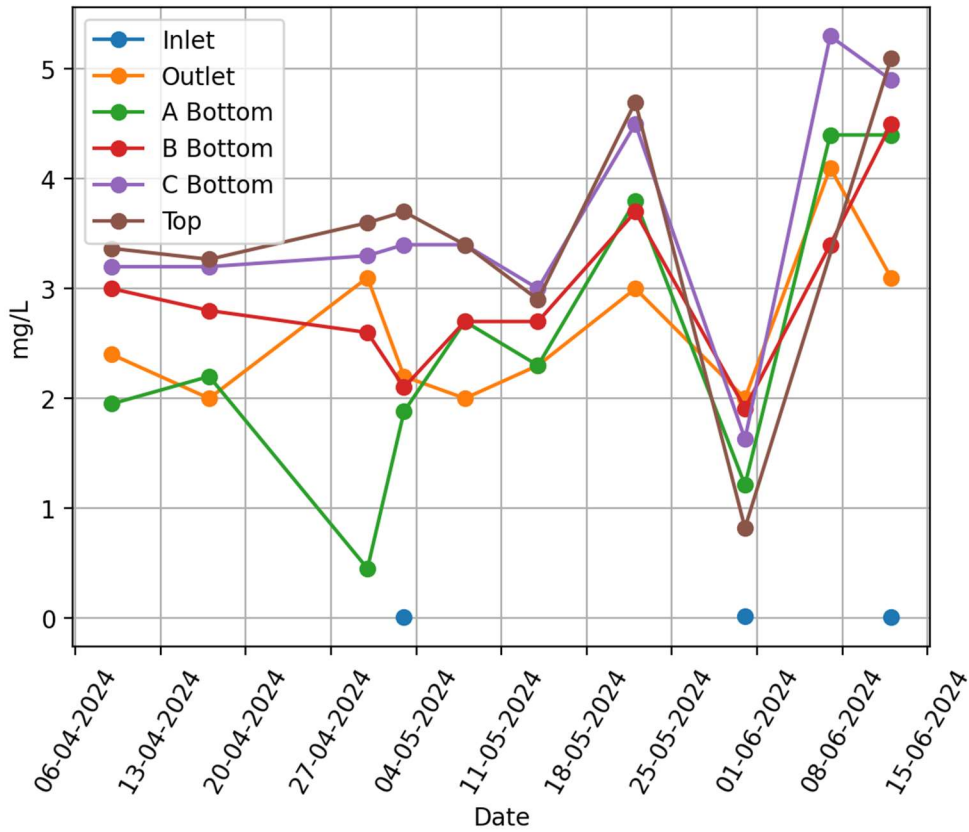


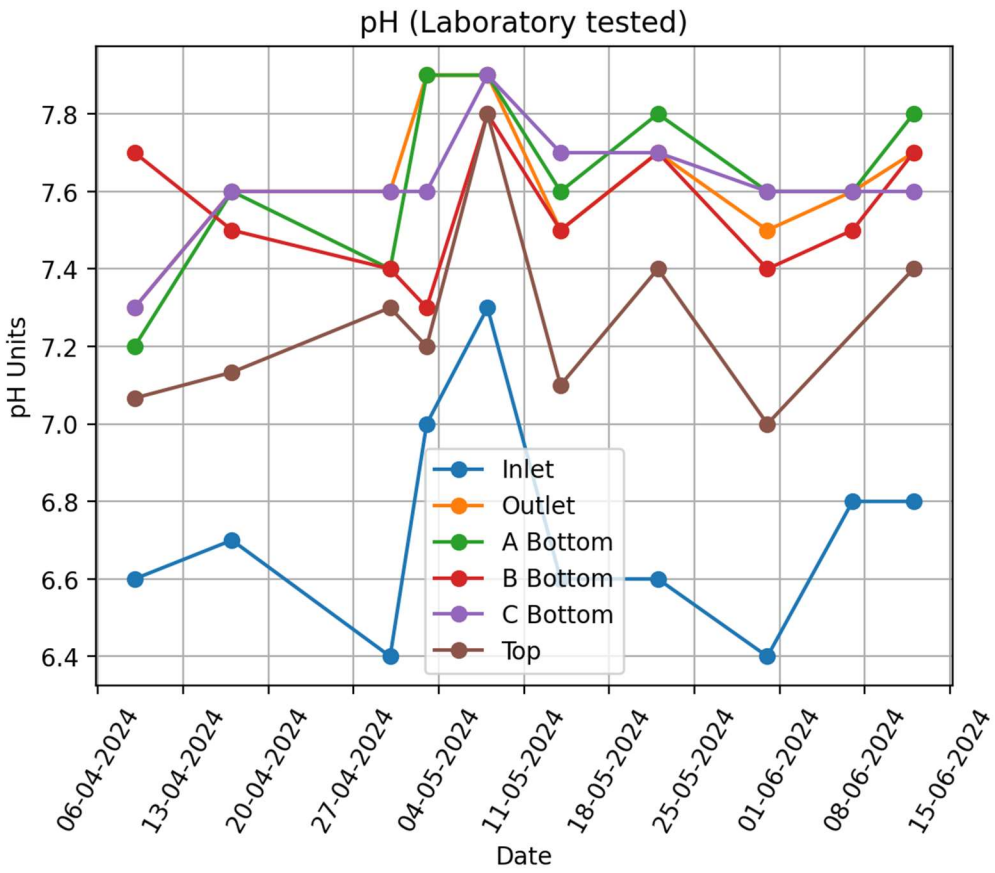
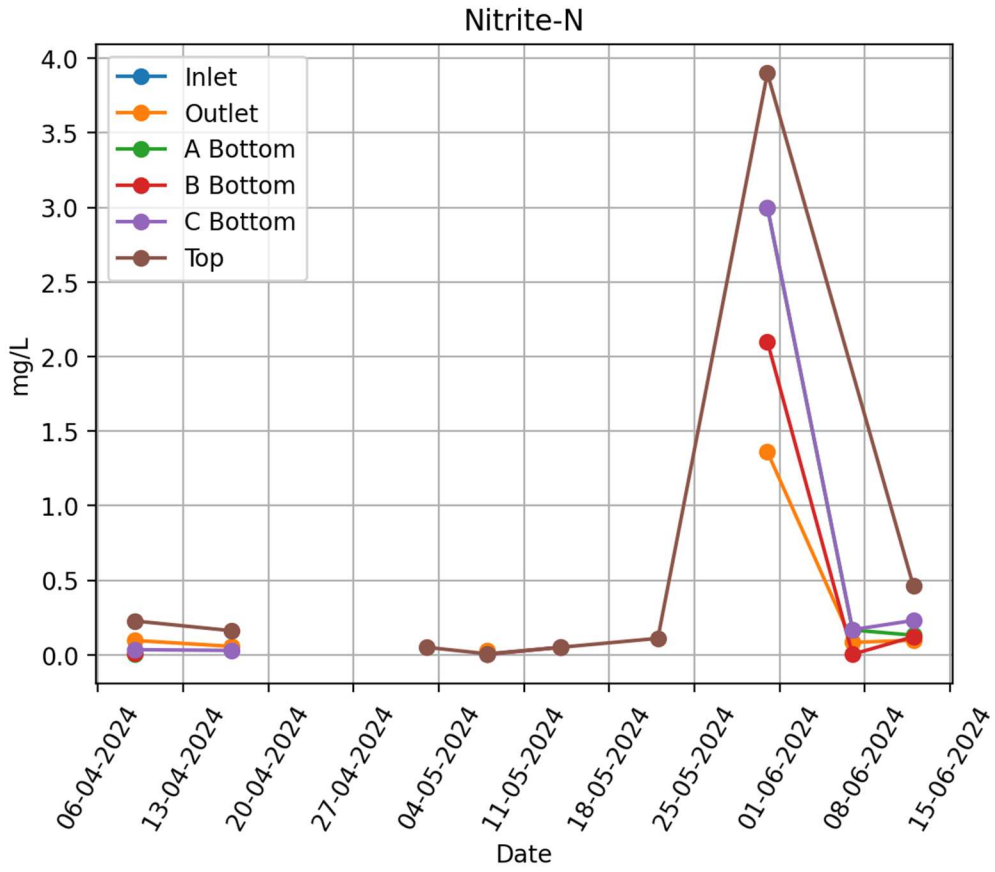


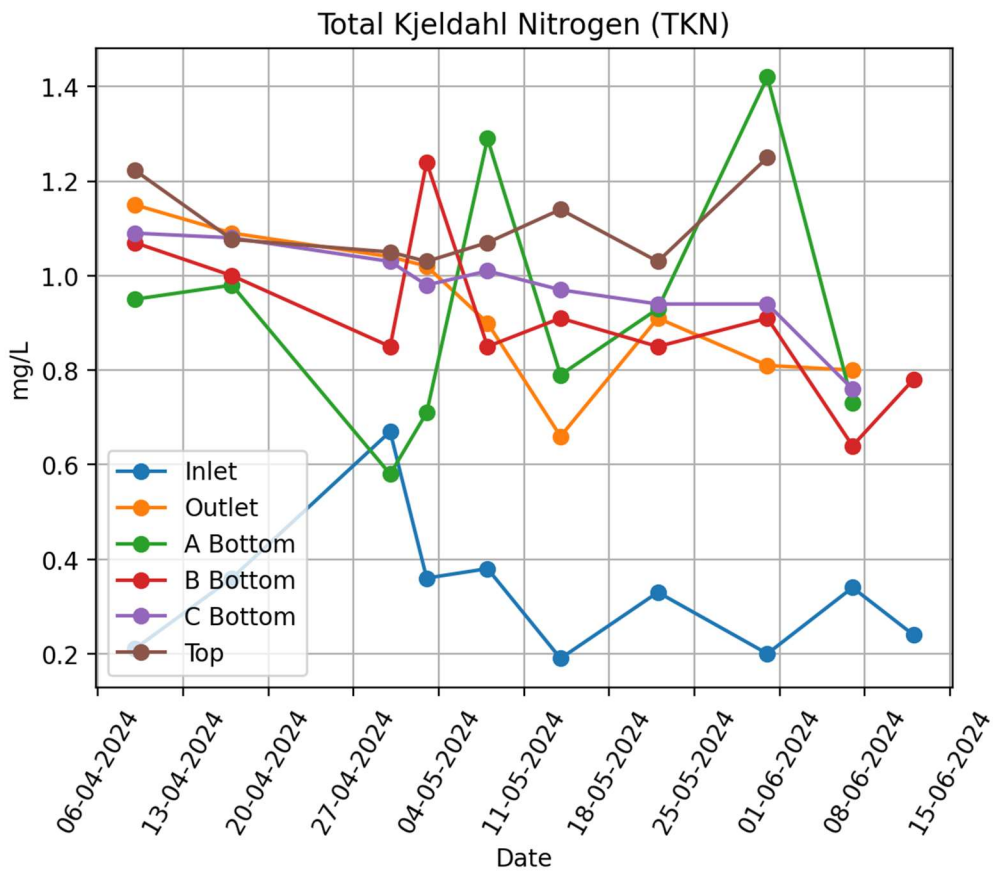
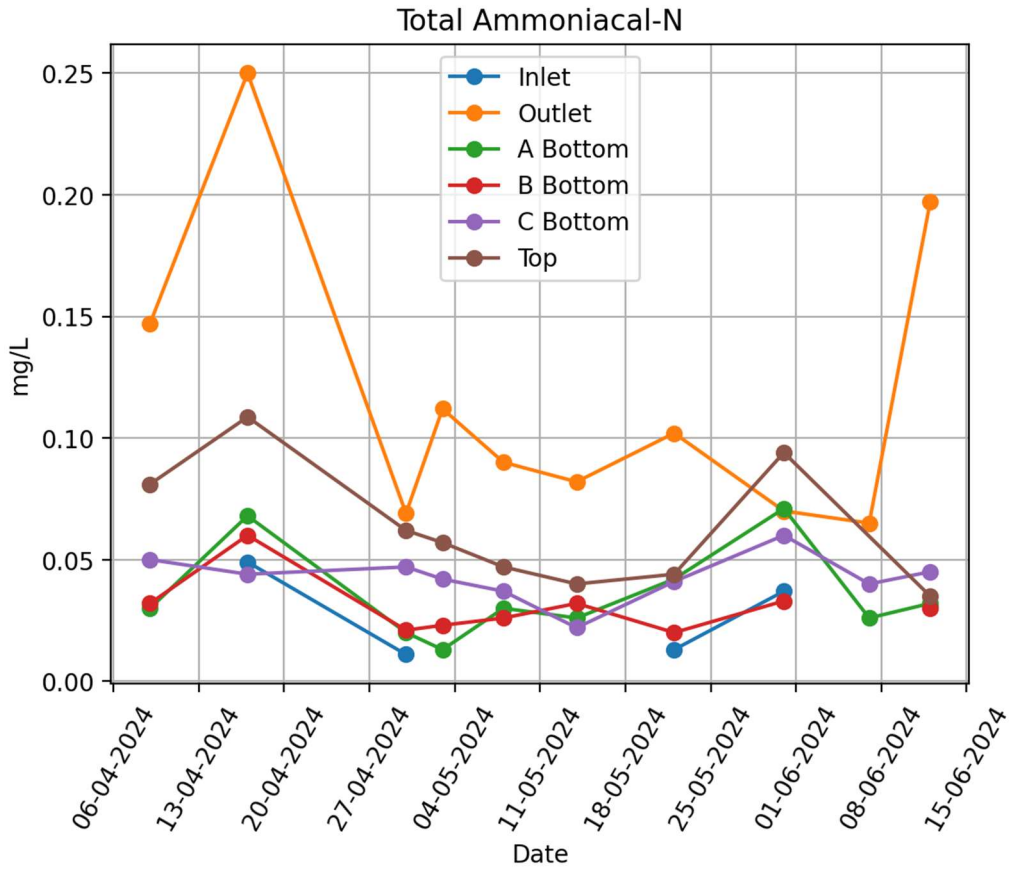
Nitrate-N + Nitrite-N

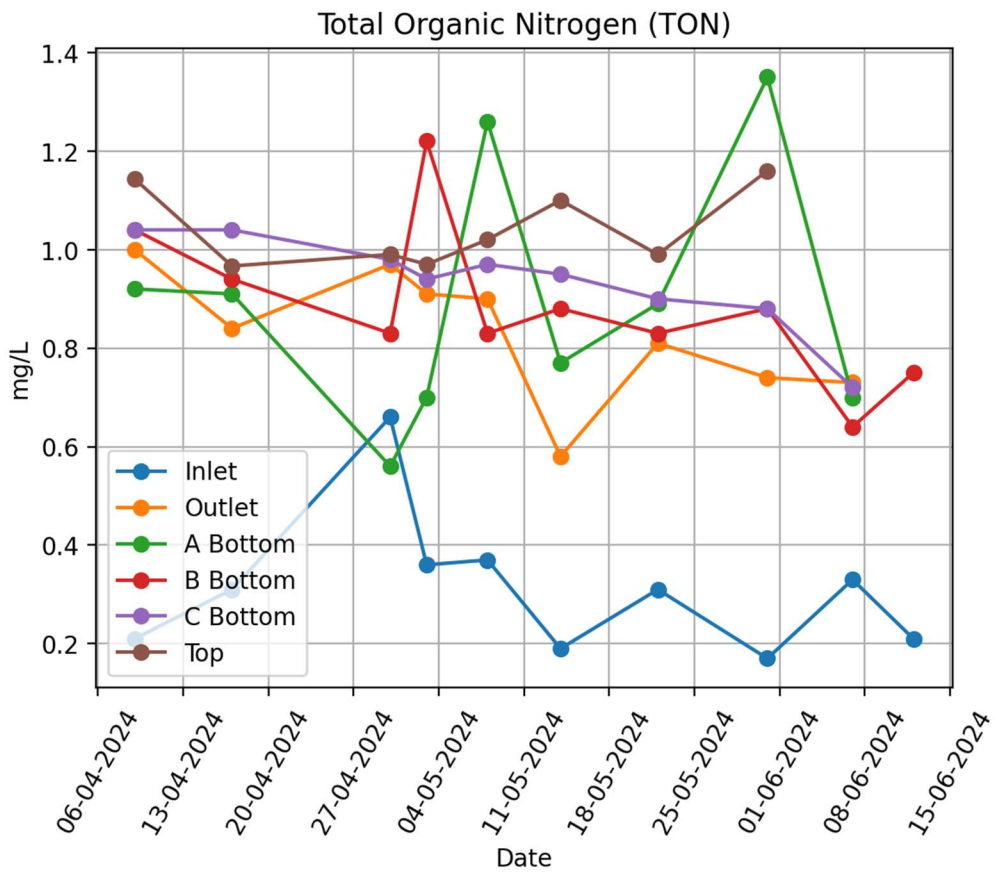
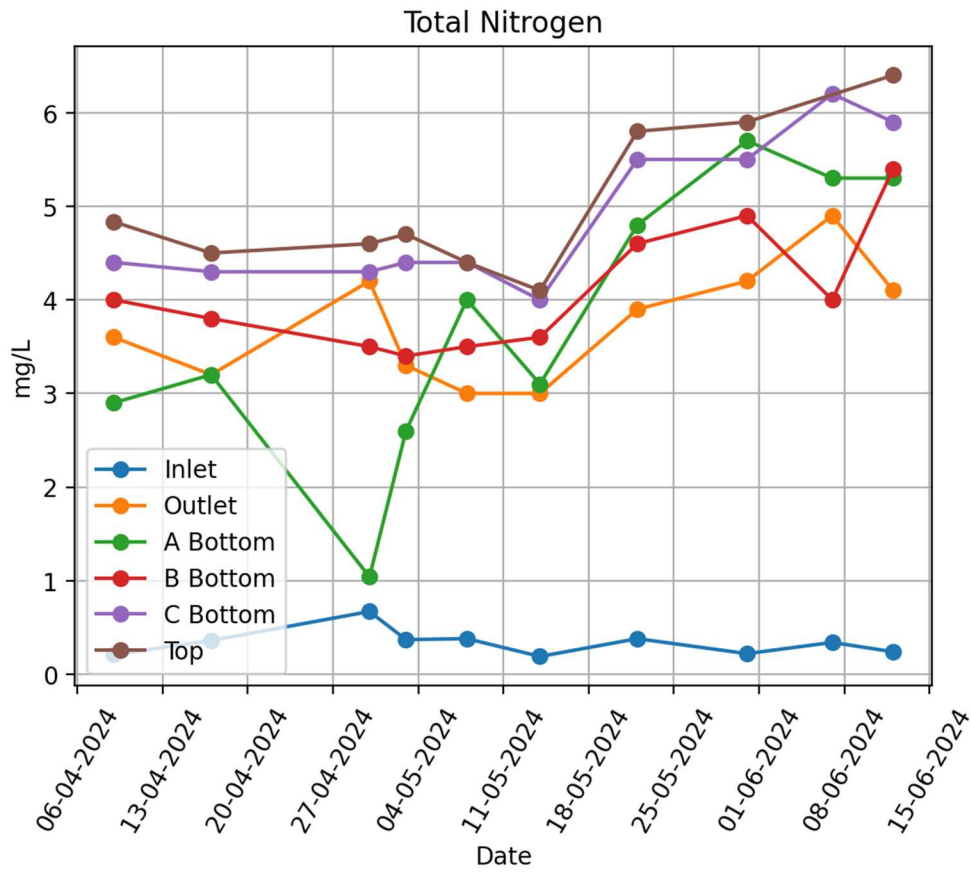


Nitrate-N

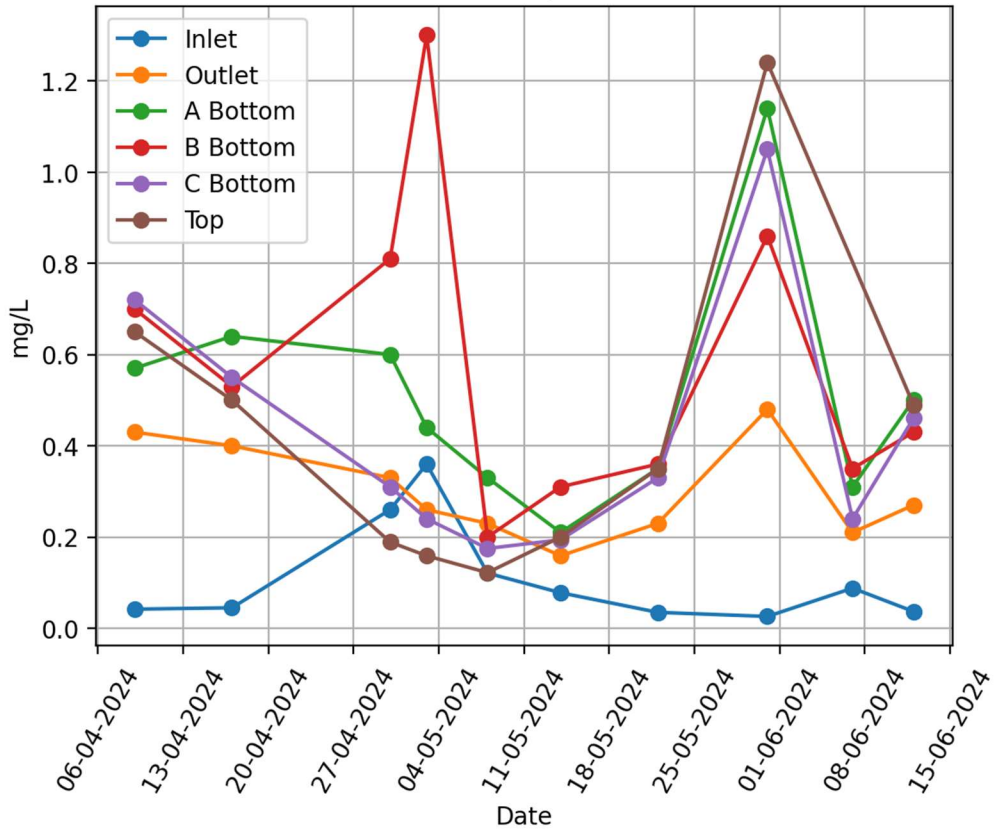




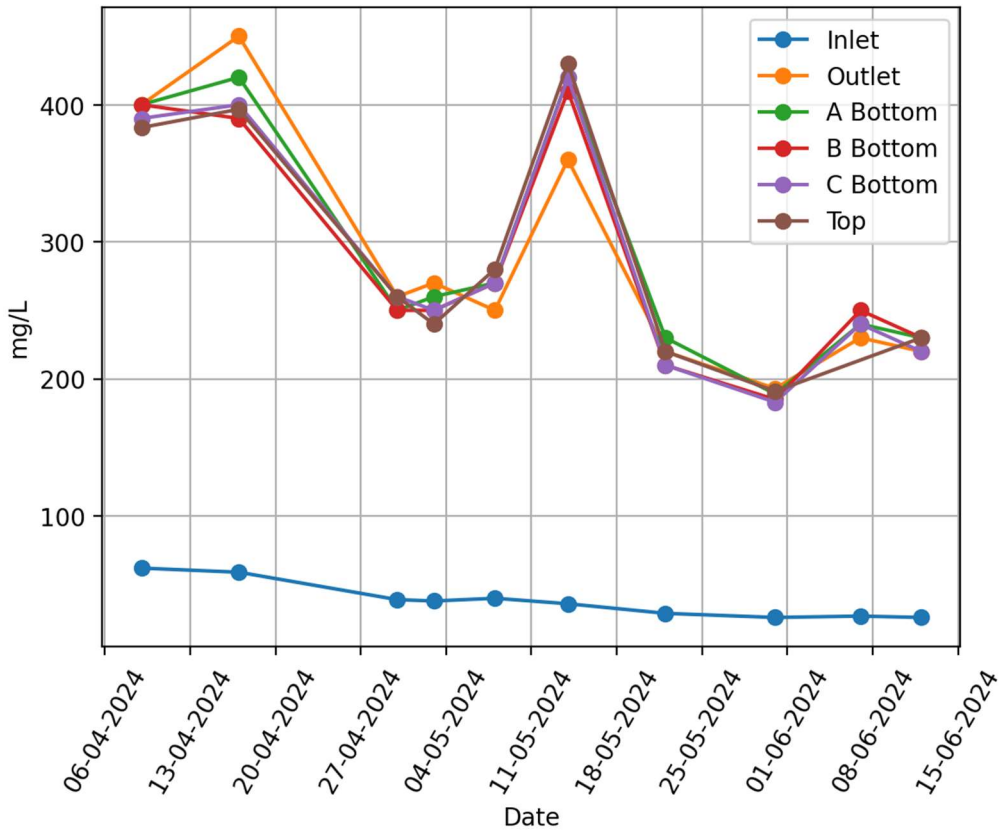




### Total Phosphorus



### Total Sodium



## Appendix B: Site Photographs

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## Appendix B: Site Photographs

### A Top Sampling Point





WATERCARE SERVICES LTD - BEACHLANDS WWTP: ASSESSMENT OF OVERLAND FLOW SYSTEM TREATMENT PERFORMANCE –  
MEMORANDUM 3 (INTERIM)





### B Top Sampling Point





WATERCARE SERVICES LTD - BEACHLANDS WWTP: ASSESSMENT OF OVERLAND FLOW SYSTEM TREATMENT PERFORMANCE –  
MEMORANDUM 3 (INTERIM)



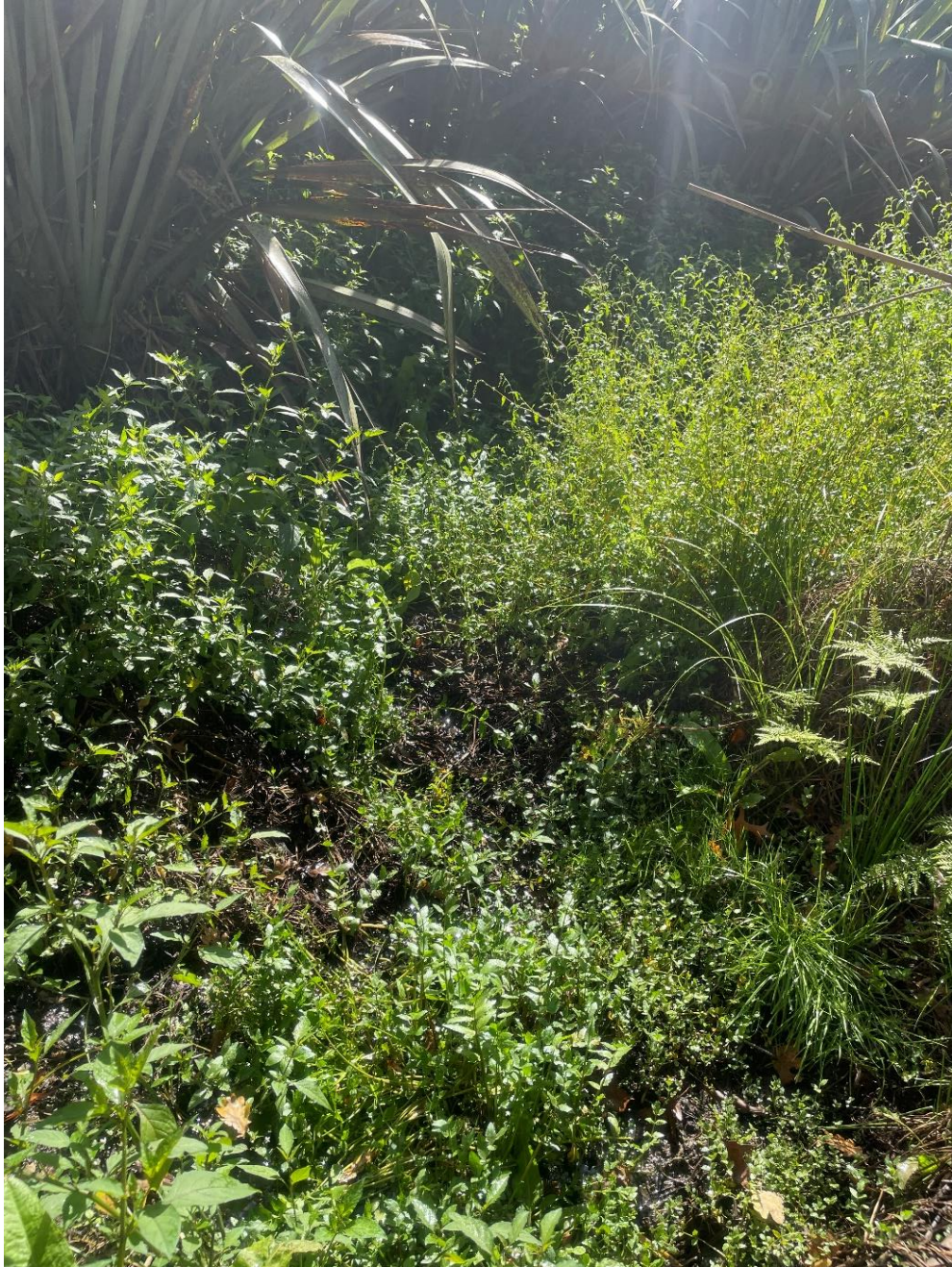


### C Top Sampling Point





### A Bottom Sampling Point













### B Bottom Sampling Point





WATERCARE SERVICES LTD - BEACHLANDS WWTP: ASSESSMENT OF OVERLAND FLOW SYSTEM TREATMENT PERFORMANCE –  
MEMORANDUM 3 (INTERIM)





WATERCARE SERVICES LTD - BEACHLANDS WWTP: ASSESSMENT OF OVERLAND FLOW SYSTEM TREATMENT PERFORMANCE –  
MEMORANDUM 3 (INTERIM)





### C Bottom Sampling Point





WATERCARE SERVICES LTD - BEACHLANDS WWTP: ASSESSMENT OF OVERLAND FLOW SYSTEM TREATMENT PERFORMANCE –  
MEMORANDUM 3 (INTERIM)





### Pond Inlet Sampling Point





WATERCARE SERVICES LTD - BEACHLANDS WWTP: ASSESSMENT OF OVERLAND FLOW SYSTEM TREATMENT PERFORMANCE –  
MEMORANDUM 3 (INTERIM)





### Pond Outlet Sampling Point





WATERCARE SERVICES LTD - BEACHLANDS WWTP: ASSESSMENT OF OVERLAND FLOW SYSTEM TREATMENT PERFORMANCE –  
MEMORANDUM 3 (INTERIM)





WATERCARE SERVICES LTD - BEACHLANDS WWTP: ASSESSMENT OF OVERLAND FLOW SYSTEM TREATMENT PERFORMANCE –  
MEMORANDUM 3 (INTERIM)





## Appendix C: Laboratory Result Certificates

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## Certificate of Analysis

Page 1 of 3

<b>Client:</b>	Pattle Delamore Partners Limited	<b>Lab No:</b>	3538507	SPV1
<b>Contact:</b>	Oliver Hunt	<b>Date Received:</b>	11-Apr-2024	
	C/- Pattle Delamore Partners Limited	<b>Date Reported:</b>	23-Apr-2024	
	PO Box 389	<b>Quote No:</b>	130161	
	Christchurch 8140	<b>Order No:</b>		
		<b>Client Reference:</b>	A028030001	
		<b>Submitted By:</b>	Kimberly Murphy	

### Sample Type: Aqueous

Sample Name:	Inlet 09-Apr-2024 12:20 pm	Outlet 09-Apr-2024 12:00 pm	A Top 09-Apr-2024 10:00 am	A Top Repeat 09-Apr-2024 10:00 am	A Bottom 09-Apr-2024 10:55 am
<b>Lab Number:</b>	3538507.1	3538507.2	3538507.3	3538507.4	3538507.5

#### Individual Tests

Turbidity	NTU	9.7	7.4	1.00	0.93	6.2
pH	pH Units	6.6	7.3	7.1	7.0	7.2
Electrical Conductivity (EC)	mS/m	43.0	238	240	238	242
Total Sodium	g/m <sup>3</sup>	62	400	370	400	400
Chloride	g/m <sup>3</sup>	110	710	710	630	660
Total Nitrogen	g/m <sup>3</sup>	0.21	3.6	4.9	4.9	2.9
Total Kjeldahl Nitrogen (TKN)	g/m <sup>3</sup>	0.21	1.15	1.18	1.21	0.95
Total Organic Nitrogen (TON)	g/m <sup>3</sup>	0.21	1.00	1.10	1.14	0.92
Total Phosphorus	g/m <sup>3</sup>	0.042	0.43	0.66	0.67	0.57
Carbonaceous Biochemical Oxygen Demand (cBOD <sub>5</sub> )	g O <sub>2</sub> /m <sup>3</sup>	2 #3	< 2 #3	< 2 #3	< 2 #3	< 2 #3
Chlorophyll a	g/m <sup>3</sup>	0.005	< 0.003	< 0.003	< 0.003	< 0.003

#### Faecal Coliforms and E. coli profile

Faecal Coliforms	cfu / 100mL	160 #1	250 #2	< 10 #1	< 10 #1	320 #2
Escherichia coli	cfu / 100mL	150 #1	250 #2	< 10 #1	< 10 #1	310 #2

#### Nutrient Profile

Total Ammoniacal-N	g/m <sup>3</sup>	< 0.010	0.147	0.079	0.072	0.030
Nitrite-N	g/m <sup>3</sup>	< 0.002	0.096	0.21	0.21	0.004
Nitrate-N	g/m <sup>3</sup>	< 0.002	2.4	3.5	3.5	1.95
Nitrate-N + Nitrite-N	g/m <sup>3</sup>	< 0.002	2.5	3.7	3.7	1.96
Dissolved Reactive Phosphorus	g/m <sup>3</sup>	0.004	0.25	0.59	0.59	0.48

Sample Name:	B Top 09-Apr-2024 9:45 am	B Bottom 09-Apr-2024 11:15 am	C Top 09-Apr-2024 9:10 am	C Bottom 09-Apr-2024 11:30 am
<b>Lab Number:</b>	3538507.6	3538507.7	3538507.8	3538507.9

#### Individual Tests

Turbidity	NTU	0.85	9.9	1.09	3.0
pH	pH Units	7.1	7.7	7.0	7.3
Electrical Conductivity (EC)	mS/m	239	240	239	240
Total Sodium	g/m <sup>3</sup>	390	400	390	390
Chloride	g/m <sup>3</sup>	680	710	700	640
Total Nitrogen	g/m <sup>3</sup>	4.8	4.0	4.8	4.4
Total Kjeldahl Nitrogen (TKN)	g/m <sup>3</sup>	1.24	1.07	1.25	1.09
Total Organic Nitrogen (TON)	g/m <sup>3</sup>	1.16	1.04	1.17	1.04
Total Phosphorus	g/m <sup>3</sup>	0.64	0.70	0.65	0.72
Carbonaceous Biochemical Oxygen Demand (cBOD <sub>5</sub> )	g O <sub>2</sub> /m <sup>3</sup>	< 2	< 2	< 2	< 2
Chlorophyll a	g/m <sup>3</sup>	< 0.003	< 0.003	< 0.003	< 0.003

Sample Type: Aqueous				
Sample Name:	B Top 09-Apr-2024 9:45 am	B Bottom 09-Apr-2024 11:15 am	C Top 09-Apr-2024 9:10 am	C Bottom 09-Apr-2024 11:30 am
Lab Number:	3538507.6	3538507.7	3538507.8	3538507.9
Faecal Coliforms and E. coli profile				
Faecal Coliforms	cfu / 100mL	90 #1	120 #1	40 #1
Escherichia coli	cfu / 100mL	50 #1	120 #1	40 #1
Nutrient Profile				
Total Ammoniacal-N	g/m <sup>3</sup>	0.085	0.032	0.079
Nitrite-N	g/m <sup>3</sup>	0.23	0.008	0.24
Nitrate-N	g/m <sup>3</sup>	3.3	3.0	3.3
Nitrate-N + Nitrite-N	g/m <sup>3</sup>	3.5	3.0	3.5
Dissolved Reactive Phosphorus	g/m <sup>3</sup>	0.53	0.55	0.50

### Analyst's Comments

#1 Statistically estimated count based on the theoretical countable range for the stated method. Please interpret this microbiological result with caution as the sample was > 24 hours old at the time of testing in the laboratory. The sample is required to reach the laboratory with sufficient time to allow testing to commence within 24 hours of sampling. Please interpret this result with caution as the sample was > 10 °C on receipt at the lab. The sample temperature is recommended by the laboratory's reference methods to be less than 10 °C on receipt at the laboratory (but not frozen). However, it is acknowledged that samples that are transported quickly to the laboratory after sampling, may not have been cooled to this temperature.

#2 Please interpret this microbiological result with caution as the sample was > 24 hours old at the time of testing in the laboratory. The sample is required to reach the laboratory with sufficient time to allow testing to commence within 24 hours of sampling. Please interpret this result with caution as the sample was > 10 °C on receipt at the lab. The sample temperature is recommended by the laboratory's reference methods to be less than 10 °C on receipt at the laboratory (but not frozen). However, it is acknowledged that samples that are transported quickly to the laboratory after sampling, may not have been cooled to this temperature.

#3 Due to unexpected sample numbers and limited resources, we were unable to commence the carbonaceous Biochemical Oxygen Demand (cBOD5) analysis on the day that the sample arrived at the laboratory. The analysis was performed, as soon as possible, on the frozen sample.

## Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Labs, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-9
Total Digestion	Nitric acid digestion. APHA 3030 E (modified) : Online Edition.	-	1-9
Turbidity	Analysis by Turbidity meter. APHA 2130 B (modified) : Online Edition.	0.05 NTU	1-9
pH	pH meter. APHA 4500-H+ B (modified) : Online Edition. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-9
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B : Online Edition.	0.1 mS/m	1-9
Total Sodium	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B : Online Edition.	0.42 g/m <sup>3</sup>	1-9
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m <sup>3</sup>	1-9
Total Nitrogen	Calculation: TKN + Nitrate-N + Nitrite-N. Please note: The Default Detection Limit of 0.05 g/m <sup>3</sup> is only attainable when the TKN has been determined using a trace method utilising duplicate analyses. In cases where the Detection Limit for TKN is 0.10 g/m <sup>3</sup> , the Default Detection Limit for Total Nitrogen will be 0.11 g/m <sup>3</sup> . In-house calculation.	0.05 g/m <sup>3</sup>	1-9

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Total Ammoniacal-N	Phenol/hypochlorite colourimetry. Flow injection analyser. (NH <sub>4</sub> -N = NH <sub>4</sub> <sup>+</sup> -N + NH <sub>3</sub> -N). APHA 4500-NH <sub>3</sub> H (modified) : Online Edition.	0.010 g/m <sup>3</sup>	1-9
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO <sub>3</sub> <sup>-</sup> I (modified) : Online Edition.	0.002 g/m <sup>3</sup>	1-9
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - Nitrite-N. In-House.	0.0010 g/m <sup>3</sup>	1-9
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO <sub>3</sub> <sup>-</sup> I (modified) : Online Edition.	0.002 g/m <sup>3</sup>	1-9
Total Kjeldahl Nitrogen (TKN)	Total Kjeldahl digestion, phenol/hypochlorite colorimetry. Discrete Analyser. APHA 4500-N <sub>org</sub> D (modified) 4500 NH <sub>3</sub> F (modified) : Online Edition.	0.10 g/m <sup>3</sup>	1-9
Total Organic Nitrogen (TON)	Calculation: TKN - NH <sub>4</sub> -N. In-house calculation.	0.10 g/m <sup>3</sup>	1-9
Dissolved Reactive Phosphorus	Filtered sample. Molybdenum blue colourimetry. Flow injection analyser. APHA 4500-P G (modified) : Online Edition.	0.004 g/m <sup>3</sup>	1-9
Total Phosphorus	Total phosphorus digestion, automated ascorbic acid colorimetry. Flow Injection Analyser. APHA 4500-P H (modified) : Online Edition.	0.002 g/m <sup>3</sup>	1-9
Carbonaceous Biochemical Oxygen Demand (cBOD <sub>5</sub> )	Incubation 5 days, DO meter, nitrification inhibitor added, seeded. APHA 5210 B (modified) : Online Edition.	2 g O <sub>2</sub> /m <sup>3</sup>	1-9
Chlorophyll a	Acetone extraction. Spectroscopy. APHA 10200 H (modified) : Online Edition.	0.003 g/m <sup>3</sup>	1-9
Nutrient Profile		0.0010 - 0.010 g/m <sup>3</sup>	1-9
Faecal Coliforms and E. coli profile			
Faecal Coliforms	Membrane Filtration, Count on CCA agar, Incubated at 44.5°C for 21-24 hours. APHA 9222 D (modified) : Online Edition.	1 cfu / 100mL	1-9
Escherichia coli	Membrane filtration, Count on CCA agar, Incubated at 44.5°C for 21-24 hours. APHA 9222 I (modified) : Online Edition.	1 cfu / 100mL	1-9

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 12-Apr-2024 and 23-Apr-2024. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Ara Heron BSc (Tech)  
Client Services Manager - Environmental

## Certificate of Analysis

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<b>Client:</b>	Pattle Delamore Partners Limited	<b>Lab No:</b>	3548288	SPV1
<b>Contact:</b>	Kimberly Murphy	<b>Date Received:</b>	18-Apr-2024	
	C/- Pattle Delamore Partners Limited	<b>Date Reported:</b>	29-Apr-2024	
	PO Box 9528	<b>Quote No:</b>	130161	
	Newmarket	<b>Order No:</b>		
	Auckland 1149	<b>Client Reference:</b>	A 028030001	
		<b>Submitted By:</b>	Kimberly Murphy	

Sample Type: Aqueous					
Sample Name:	A Top 17-Apr-2024 9:15 am	B Top 17-Apr-2024 8:55 am	C Top 17-Apr-2024 8:45 am	A Top Repeat 17-Apr-2024 9:20 am	
Lab Number:	3548288.1	3548288.2	3548288.3	3548288.4	
Individual Tests					
Turbidity	NTU	0.52	0.66	0.83	0.72
pH	pH Units	7.1	7.2	7.1	7.1
Electrical Conductivity (EC)	mS/m	257	260	262	258
Total Sodium	g/m <sup>3</sup>	390	400	400	390
Chloride	g/m <sup>3</sup>	750	740	720	740
Total Nitrogen	g/m <sup>3</sup>	4.5	4.5	4.5	4.6
Total Kjeldahl Nitrogen (TKN)	g/m <sup>3</sup>	1.05	1.10	1.08	1.14
Total Organic Nitrogen (TON)	g/m <sup>3</sup>	0.86	1.02	1.02	0.86
Total Phosphorus	g/m <sup>3</sup>	0.53	0.49	0.48	0.50
Carbonaceous Biochemical Oxygen Demand (cBOD <sub>5</sub> )	g O <sub>2</sub> /m <sup>3</sup>	< 2	< 2	< 2	< 2
Chlorophyll a	g/m <sup>3</sup>	< 0.003	< 0.003	< 0.003	< 0.003
Faecal Coliforms and E. coli profile					
Faecal Coliforms	cfu / 100mL	< 10 #1	20 #1	60 #1	10 #1
Escherichia coli	cfu / 100mL	< 10 #1	20 #1	60 #1	10 #1
Nutrient Profile					
Total Ammoniacal-N	g/m <sup>3</sup>	0.187	0.082	0.057	0.29
Nitrite-N	g/m <sup>3</sup>	0.130	0.167	0.186	0.132
Nitrate-N	g/m <sup>3</sup>	3.3	3.3	3.2	3.3
Nitrate-N + Nitrite-N	g/m <sup>3</sup>	3.5	3.4	3.4	3.5
Dissolved Reactive Phosphorus	g/m <sup>3</sup>	0.42	0.41	0.39	0.42

**Analyst's Comments**

#1 Statistically estimated count based on the theoretical countable range for the stated method.  
Please interpret this microbiological result with caution as the sample was > 24 hours old at the time of testing in the laboratory. The sample is required to reach the laboratory with sufficient time to allow testing to commence within 24 hours of sampling.  
Please interpret this result with caution as the sample was > 10 °C on receipt at the lab. The sample temperature is recommended by the laboratory's reference methods to be less than 10 °C on receipt at the laboratory (but not frozen). However, it is acknowledged that samples that are transported quickly to the laboratory after sampling, may not have been cooled to this temperature.

## Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Labs, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Individual Tests			



This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised. The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked \* or any comments and interpretations, which are not accredited.

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-4
Total Digestion	Nitric acid digestion. APHA 3030 E (modified) : Online Edition.	-	1-4
Turbidity	Analysis by Turbidity meter. APHA 2130 B (modified) : Online Edition.	0.05 NTU	1-4
pH	pH meter. APHA 4500-H <sup>+</sup> B (modified) : Online Edition. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-4
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B : Online Edition.	0.1 mS/m	1-4
Total Sodium	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B : Online Edition.	0.42 g/m <sup>3</sup>	1-4
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m <sup>3</sup>	1-4
Total Nitrogen	Calculation: TKN + Nitrate-N + Nitrite-N. Please note: The Default Detection Limit of 0.05 g/m <sup>3</sup> is only attainable when the TKN has been determined using a trace method utilising duplicate analyses. In cases where the Detection Limit for TKN is 0.10 g/m <sup>3</sup> , the Default Detection Limit for Total Nitrogen will be 0.11 g/m <sup>3</sup> . In-house calculation.	0.05 g/m <sup>3</sup>	1-4
Total Ammoniacal-N	Phenol/hypochlorite colourimetry. Flow injection analyser. (NH <sub>4</sub> -N = NH <sub>4</sub> <sup>+</sup> -N + NH <sub>3</sub> -N). APHA 4500-NH <sub>3</sub> H (modified) : Online Edition.	0.010 g/m <sup>3</sup>	1-4
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO <sub>2</sub> <sup>-</sup> I (modified) : Online Edition.	0.002 g/m <sup>3</sup>	1-4
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - Nitrite-N. In-House.	0.0010 g/m <sup>3</sup>	1-4
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO <sub>3</sub> <sup>-</sup> I (modified) : Online Edition.	0.002 g/m <sup>3</sup>	1-4
Total Kjeldahl Nitrogen (TKN)	Total Kjeldahl digestion, phenol/hypochlorite colorimetry. Discrete Analyser. APHA 4500-N <sub>org</sub> D (modified) 4500 NH <sub>3</sub> F (modified) : Online Edition.	0.10 g/m <sup>3</sup>	1-4
Total Organic Nitrogen (TON)	Calculation: TKN - NH <sub>4</sub> -N. In-house calculation.	0.10 g/m <sup>3</sup>	1-4
Dissolved Reactive Phosphorus	Filtered sample. Molybdenum blue colourimetry. Flow injection analyser. APHA 4500-P G (modified) : Online Edition.	0.004 g/m <sup>3</sup>	1-4
Total Phosphorus	Total phosphorus digestion, automated ascorbic acid colorimetry. Flow Injection Analyser. APHA 4500-P H (modified) : Online Edition.	0.002 g/m <sup>3</sup>	1-4
Carbonaceous Biochemical Oxygen Demand (cBOD <sub>5</sub> )	Incubation 5 days, DO meter, nitrification inhibitor added, seeded. APHA 5210 B (modified) : Online Edition.	2 g O <sub>2</sub> /m <sup>3</sup>	1-4
Chlorophyll a	Acetone extraction. Spectroscopy. APHA 10200 H (modified) : Online Edition.	0.003 g/m <sup>3</sup>	1-4
Nutrient Profile		0.0010 - 0.010 g/m <sup>3</sup>	1-4
Faecal Coliforms and E. coli profile			
Faecal Coliforms	Membrane Filtration, Count on CCA agar, Incubated at 44.5°C for 21-24 hours. APHA 9222 D (modified) : Online Edition.	1 cfu / 100mL	1-4
Escherichia coli	Membrane filtration, Count on CCA agar, Incubated at 44.5°C for 21-24 hours. APHA 9222 I (modified) : Online Edition.	1 cfu / 100mL	1-4

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 19-Apr-2024 and 29-Apr-2024. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Martin Cowell - BSc  
Client Services Manager - Environmental

## Certificate of Analysis

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<b>Client:</b>	Pattle Delamore Partners Limited	<b>Lab No:</b>	3548347	SPV1
<b>Contact:</b>	Kimberly Murphy C/- Pattle Delamore Partners Limited PO Box 9528 Newmarket Auckland 1149	<b>Date Received:</b>	18-Apr-2024	
		<b>Date Reported:</b>	29-Apr-2024	
		<b>Quote No:</b>	130161	
		<b>Order No:</b>		
		<b>Client Reference:</b>	A028030001	
		<b>Submitted By:</b>	Kimberly Murphy	

### Sample Type: Aqueous

Sample Name:	A Bottom 17-Apr-2024 11:05 am	B Bottom 17-Apr-2024 10:05 am	C Bottom 17-Apr-2024 9:50 am	Inlet 17-Apr-2024 10:35 am	Outlet 17-Apr-2024 10:50 am	
<b>Lab Number:</b>	3548347.1	3548347.2	3548347.3	3548347.4	3548347.5	
Individual Tests						
Turbidity	NTU	17.6	6.5	3.5	10.0	2.3
pH	pH Units	7.6	7.5	7.6	6.7	7.6
Electrical Conductivity (EC)	mS/m	266	262	260	42.6	286
Total Sodium	g/m <sup>3</sup>	420	390	400	59	450
Chloride	g/m <sup>3</sup>	730	750	730	111	840
Total Nitrogen	g/m <sup>3</sup>	3.2	3.8	4.3	0.36	3.2
Total Kjeldahl Nitrogen (TKN)	g/m <sup>3</sup>	0.98	1.00	1.08	0.36	1.09
Total Organic Nitrogen (TON)	g/m <sup>3</sup>	0.91	0.94	1.04	0.31	0.84
Total Phosphorus	g/m <sup>3</sup>	0.64	0.53	0.55	0.045	0.40
Carbonaceous Biochemical Oxygen Demand (cBOD <sub>5</sub> )	g O <sub>2</sub> /m <sup>3</sup>	< 2	< 2	< 2	< 2	< 2
Chlorophyll a	g/m <sup>3</sup>	< 0.003	< 0.003	< 0.003	0.041	< 0.003
Faecal Coliforms and E. coli profile						
Faecal Coliforms	cfu / 100mL	640 #1	440 #2	300 #2	420 #2	130 #1
Escherichia coli	cfu / 100mL	630 #1	160 #2	300 #2	420 #2	130 #1
Nutrient Profile						
Total Ammoniacal-N	g/m <sup>3</sup>	0.068	0.060	0.044	0.049	0.25
Nitrite-N	g/m <sup>3</sup>	< 0.002	< 0.002	0.029	< 0.002	0.056
Nitrate-N	g/m <sup>3</sup>	2.2	2.8	3.2	< 0.002	2.0
Nitrate-N + Nitrite-N	g/m <sup>3</sup>	2.2	2.8	3.3	0.002	2.1
Dissolved Reactive Phosphorus	g/m <sup>3</sup>	0.38	0.39	0.44	0.008	0.30

### Analyst's Comments

#1 Statistically estimated count based on the theoretical countable range for the stated method. Please interpret this result with caution as the sample was > 10 °C on receipt at the lab. The sample temperature is recommended by the laboratory's reference methods to be less than 10 °C on receipt at the laboratory (but not frozen). However, it is acknowledged that samples that are transported quickly to the laboratory after sampling, may not have been cooled to this temperature.

#2 Please interpret this result with caution as the sample was > 10 °C on receipt at the lab. The sample temperature is recommended by the laboratory's reference methods to be less than 10 °C on receipt at the laboratory (but not frozen). However, it is acknowledged that samples that are transported quickly to the laboratory after sampling, may not have been cooled to this temperature.



# Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Labs, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-5
Total Digestion	Nitric acid digestion. APHA 3030 E (modified) : Online Edition.	-	1-5
Turbidity	Analysis by Turbidity meter. APHA 2130 B (modified) : Online Edition.	0.05 NTU	1-5
pH	pH meter. APHA 4500-H <sup>+</sup> B (modified) : Online Edition. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-5
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B : Online Edition.	0.1 mS/m	1-5
Total Sodium	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B : Online Edition.	0.42 g/m <sup>3</sup>	1-5
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m <sup>3</sup>	1-5
Total Nitrogen	Calculation: TKN + Nitrate-N + Nitrite-N. Please note: The Default Detection Limit of 0.05 g/m <sup>3</sup> is only attainable when the TKN has been determined using a trace method utilising duplicate analyses. In cases where the Detection Limit for TKN is 0.10 g/m <sup>3</sup> , the Default Detection Limit for Total Nitrogen will be 0.11 g/m <sup>3</sup> . In-house calculation.	0.05 g/m <sup>3</sup>	1-5
Total Ammoniacal-N	Phenol/hypochlorite colourimetry. Flow injection analyser. (NH <sub>4</sub> -N = NH <sub>4</sub> <sup>+</sup> -N + NH <sub>3</sub> -N). APHA 4500-NH <sub>3</sub> H (modified) : Online Edition.	0.010 g/m <sup>3</sup>	1-5
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO <sub>3</sub> <sup>-</sup> I (modified) : Online Edition.	0.002 g/m <sup>3</sup>	1-5
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - Nitrite-N. In-House.	0.0010 g/m <sup>3</sup>	1-5
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO <sub>3</sub> <sup>-</sup> I (modified) : Online Edition.	0.002 g/m <sup>3</sup>	1-5
Total Kjeldahl Nitrogen (TKN)	Total Kjeldahl digestion, phenol/hypochlorite colorimetry. Discrete Analyser. APHA 4500-N <sub>org</sub> D (modified) 4500 NH <sub>3</sub> F (modified) : Online Edition.	0.10 g/m <sup>3</sup>	1-5
Total Organic Nitrogen (TON)	Calculation: TKN - NH <sub>4</sub> -N. In-house calculation.	0.10 g/m <sup>3</sup>	1-5
Dissolved Reactive Phosphorus	Filtered sample. Molybdenum blue colourimetry. Flow injection analyser. APHA 4500-P G (modified) : Online Edition.	0.004 g/m <sup>3</sup>	1-5
Total Phosphorus	Total phosphorus digestion, automated ascorbic acid colorimetry. Flow Injection Analyser. APHA 4500-P H (modified) : Online Edition.	0.002 g/m <sup>3</sup>	1-5
Carbonaceous Biochemical Oxygen Demand (cBOD <sub>5</sub> )	Incubation 5 days, DO meter, nitrification inhibitor added, seeded. APHA 5210 B (modified) : Online Edition.	2 g O <sub>2</sub> /m <sup>3</sup>	1-5
Chlorophyll a	Acetone extraction. Spectroscopy. APHA 10200 H (modified) : Online Edition.	0.003 g/m <sup>3</sup>	1-5
Nutrient Profile		0.0010 - 0.010 g/m <sup>3</sup>	1-5
Faecal Coliforms and E. coli profile			
Faecal Coliforms	Membrane Filtration, Count on CCA agar, Incubated at 44.5°C for 21-24 hours. APHA 9222 D (modified) : Online Edition.	1 cfu / 100mL	1-5
Escherichia coli	Membrane filtration, Count on CCA agar, Incubated at 44.5°C for 21-24 hours. APHA 9222 I (modified) : Online Edition.	1 cfu / 100mL	1-5



These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 19-Apr-2024 and 29-Apr-2024. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Martin Cowell - BSc  
Client Services Manager - Environmental

## Certificate of Analysis

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<b>Client:</b>	Pattle Delamore Partners Limited	<b>Lab No:</b>	3565150	SPV1
<b>Contact:</b>	Kimberly Murphy C/- Pattle Delamore Partners Limited PO Box 9528 Newmarket Auckland 1149	<b>Date Received:</b>	01-May-2024	
		<b>Date Reported:</b>	08-May-2024	
		<b>Quote No:</b>	130161	
		<b>Order No:</b>		
		<b>Client Reference:</b>	AO2803001	
		<b>Add. Client Ref:</b>	130161	
		<b>Submitted By:</b>	Kimberly Murphy	

### Sample Type: Aqueous

Sample Name:	Inlet 30-Apr-2024 8:45 am	Outlet 30-Apr-2024 9:15 am	A bottom 30-Apr-2024 9:40 am	B bottom 30-Apr-2024 10:45 am	C bottom 30-Apr-2024 10:30 am
<b>Lab Number:</b>	3565150.1	3565150.2	3565150.3	3565150.4	3565150.5

#### Individual Tests

Parameter	Units	3565150.1	3565150.2	3565150.3	3565150.4	3565150.5
Turbidity	NTU	33	2.1	25	37	6.2
pH	pH Units	6.4	7.6	7.4	7.4	7.6
Electrical Conductivity (EC)	mS/m	28.6	159.0	157.6	152.4	155.8
Total Sodium	g/m <sup>3</sup>	39	260	250	250	260
Chloride	g/m <sup>3</sup>	62	380	360	340	360
Total Nitrogen	g/m <sup>3</sup>	0.67	4.2	1.04	3.5	4.3
Total Kjeldahl Nitrogen (TKN)	g/m <sup>3</sup>	0.67	1.04	0.58	0.85	1.03
Total Organic Nitrogen (TON)	g/m <sup>3</sup>	0.66	0.97	0.56	0.83	0.98
Total Phosphorus	g/m <sup>3</sup>	0.26	0.33	0.60	0.81	0.31
Carbonaceous Biochemical Oxygen Demand (cBOD <sub>5</sub> )	g O <sub>2</sub> /m <sup>3</sup>	12	< 2	< 2	4	2
Chlorophyll a	g/m <sup>3</sup>	0.006	< 0.003	< 0.003	< 0.003	< 0.003

#### Faecal Coliforms and E. coli profile

Parameter	Units	3565150.1	3565150.2	3565150.3	3565150.4	3565150.5
Faecal Coliforms	cfu / 100mL	< 100 #1	500 #1	400 #1	300 #1	220 #2
Escherichia coli	cfu / 100mL	< 100 #1	500 #1	400 #1	300 #1	160 #2

#### Nutrient Profile

Parameter	Units	3565150.1	3565150.2	3565150.3	3565150.4	3565150.5
Total Ammoniacal-N	g/m <sup>3</sup>	0.011	0.069	0.02	0.021	0.047
Nitrite-N	g/m <sup>3</sup>	< 0.002	< 0.10	< 0.10	< 0.10	< 0.10
Nitrate-N	g/m <sup>3</sup>	< 0.002	3.1	0.45	2.6	3.3
Nitrate-N + Nitrite-N	g/m <sup>3</sup>	0.002	3.1	0.45	2.6	3.3
Dissolved Reactive Phosphorus	g/m <sup>3</sup>	0.006	0.26	0.47	0.28	0.198

Sample Name:	C top repeat 30-Apr-2024 10:10 am	C top 30-Apr-2024 10:10 am
<b>Lab Number:</b>	3565150.6	3565150.7

#### Individual Tests

Parameter	Units	3565150.6	3565150.7
Turbidity	NTU	0.57	0.62
pH	pH Units	7.3	7.3
Electrical Conductivity (EC)	mS/m	155.4	156.0
Total Sodium	g/m <sup>3</sup>	260	260
Chloride	g/m <sup>3</sup>	350	350
Total Nitrogen	g/m <sup>3</sup>	4.6	4.6
Total Kjeldahl Nitrogen (TKN)	g/m <sup>3</sup>	1.10	1.05
Total Organic Nitrogen (TON)	g/m <sup>3</sup>	1.05	0.99
Total Phosphorus	g/m <sup>3</sup>	0.181	0.189
Carbonaceous Biochemical Oxygen Demand (cBOD <sub>5</sub> )	g O <sub>2</sub> /m <sup>3</sup>	< 2	< 2
Chlorophyll a	g/m <sup>3</sup>	< 0.003	< 0.003

Sample Type: Aqueous			
<b>Sample Name:</b>		C top repeat 30-Apr-2024 10:10 am	C top 30-Apr-2024 10:10 am
<b>Lab Number:</b>		3565150.6	3565150.7
Faecal Coliforms and E. coli profile			
Faecal Coliforms	cfu / 100mL	< 10 #3	< 10 #3
Escherichia coli	cfu / 100mL	< 10 #3	< 10 #3
Nutrient Profile			
Total Ammoniacal-N	g/m <sup>3</sup>	0.049	0.062
Nitrite-N	g/m <sup>3</sup>	< 0.10	< 0.10
Nitrate-N	g/m <sup>3</sup>	3.5	3.6
Nitrate-N + Nitrite-N	g/m <sup>3</sup>	3.5	3.6
Dissolved Reactive Phosphorus	g/m <sup>3</sup>	0.108	0.107

### Analyst's Comments

#1 Statistically estimated count based on the theoretical countable range for the stated method.

#2 Please interpret this microbiological result with caution as the sample required repeat analysis. Due to incubation times it is not possible to perform a repeat analysis within 24 hours of sampling as required by the method. Repeats are typically due to unexpected analyte levels.

#3 Statistically estimated count based on the theoretical countable range for the stated method.

Please interpret this microbiological result with caution as the sample required repeat analysis. Due to incubation times it is not possible to perform a repeat analysis within 24 hours of sampling as required by the method. Repeats are typically due to unexpected analyte levels.

## Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Labs, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-7
Total Digestion	Nitric acid digestion. APHA 3030 E (modified) : Online Edition.	-	1-7
Turbidity	Analysis by Turbidity meter. APHA 2130 B (modified) : Online Edition.	0.05 NTU	1-7
pH	pH meter. APHA 4500-H+ B (modified) : Online Edition. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-7
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B : Online Edition.	0.1 mS/m	1-7
Total Sodium	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B : Online Edition.	0.42 g/m <sup>3</sup>	1-7
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m <sup>3</sup>	1-7
Total Nitrogen	Calculation: TKN + Nitrate-N + Nitrite-N. Please note: The Default Detection Limit of 0.05 g/m <sup>3</sup> is only attainable when the TKN has been determined using a trace method utilising duplicate analyses. In cases where the Detection Limit for TKN is 0.10 g/m <sup>3</sup> , the Default Detection Limit for Total Nitrogen will be 0.11 g/m <sup>3</sup> . In-house calculation.	0.05 g/m <sup>3</sup>	1-7
Total Ammoniacal-N	Phenol/hypochlorite colourimetry. Flow injection analyser. (NH <sub>4</sub> -N = NH <sub>4</sub> <sup>+</sup> -N + NH <sub>3</sub> -N). APHA 4500-NH <sub>3</sub> H (modified) : Online Edition.	0.010 g/m <sup>3</sup>	1-7
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO <sub>3</sub> <sup>-</sup> I (modified) : Online Edition.	0.002 g/m <sup>3</sup>	1-7
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - Nitrite-N. In-House.	0.0010 g/m <sup>3</sup>	1-7
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO <sub>3</sub> <sup>-</sup> I (modified) : Online Edition.	0.002 g/m <sup>3</sup>	1-7
Total Kjeldahl Nitrogen (TKN)	Total Kjeldahl digestion, phenol/hypochlorite colorimetry. Discrete Analyser. APHA 4500-N <sub>org</sub> D (modified) 4500 NH <sub>3</sub> F (modified) : Online Edition.	0.10 g/m <sup>3</sup>	1-7
Total Organic Nitrogen (TON)	Calculation: TKN - NH <sub>4</sub> -N. In-house calculation.	0.10 g/m <sup>3</sup>	1-7

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Dissolved Reactive Phosphorus	Filtered sample. Molybdenum blue colourimetry. Flow injection analyser. APHA 4500-P G (modified) : Online Edition.	0.004 g/m <sup>3</sup>	1-7
Total Phosphorus	Total phosphorus digestion, automated ascorbic acid colorimetry. Flow Injection Analyser. APHA 4500-P H (modified) : Online Edition.	0.002 g/m <sup>3</sup>	1-7
Carbonaceous Biochemical Oxygen Demand (cBOD <sub>5</sub> )	Incubation 5 days, DO meter, nitrification inhibitor added, seeded. APHA 5210 B (modified) : Online Edition.	2 g O <sub>2</sub> /m <sup>3</sup>	1-7
Chlorophyll a	Acetone extraction. Spectroscopy. APHA 10200 H (modified) : Online Edition.	0.003 g/m <sup>3</sup>	1-7
Nutrient Profile		0.0010 - 0.010 g/m <sup>3</sup>	1-7
Faecal Coliforms and E. coli profile			
Faecal Coliforms	Membrane Filtration, Count on CCA agar, Incubated at 44.5°C for 21-24 hours. APHA 9222 D (modified) : Online Edition.	1 cfu / 100mL	1-7
Escherichia coli	Membrane filtration, Count on CCA agar, Incubated at 44.5°C for 21-24 hours. APHA 9222 I (modified) : Online Edition.	1 cfu / 100mL	1-7

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 02-May-2024 and 08-May-2024. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Kim Harrison MSc  
Client Services Manager - Environmental



## Certificate of Analysis

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<b>Client:</b>	Pattle Delamore Partners Limited	<b>Lab No:</b>	3570063	SPV1
<b>Contact:</b>	Kimberly Murphy C/- Pattle Delamore Partners Limited PO Box 9528 Newmarket Auckland 1149	<b>Date Received:</b>	04-May-2024	
		<b>Date Reported:</b>	10-May-2024	
		<b>Quote No:</b>	130161	
		<b>Order No:</b>		
		<b>Client Reference:</b>		
		<b>Submitted By:</b>	Kimberly Murphy	

Sample Type: Aqueous				
Sample Name:		C Bottom 03-May-2024 9:55 am	C Top 03-May-2024 10:35 am	C Top Repeat 03-May-2024 10:35 am
Lab Number:		3570063.1	3570063.2	3570063.3
Individual Tests				
Turbidity	NTU	5.8	0.62	0.77
pH	pH Units	7.6	7.2	7.3
Electrical Conductivity (EC)	mS/m	156.2	155.6	155.7
Total Sodium	g/m <sup>3</sup>	250	240	240
Chloride	g/m <sup>3</sup>	370	350	360
Total Nitrogen	g/m <sup>3</sup>	4.4	4.7	4.6
Total Kjeldahl Nitrogen (TKN)	g/m <sup>3</sup>	0.98	1.03	1.04
Total Organic Nitrogen (TON)	g/m <sup>3</sup>	0.94	0.97	0.98
Total Phosphorus	g/m <sup>3</sup>	0.24	0.159	0.163
Carbonaceous Biochemical Oxygen Demand (cBOD <sub>5</sub> )	g O <sub>2</sub> /m <sup>3</sup>	< 2	< 2	< 2
Chlorophyll a	g/m <sup>3</sup>	< 0.003	< 0.003	< 0.003
Faecal Coliforms and E. coli profile				
Faecal Coliforms	cfu / 100mL	160 #1	180 #1	240 #3
Escherichia coli	cfu / 100mL	160 #1	< 10 #1	< 10 #3
Nutrient Profile				
Total Ammoniacal-N	g/m <sup>3</sup>	0.042	0.057	0.061
Nitrite-N	g/m <sup>3</sup>	< 0.10	< 0.10 #2	< 0.10
Nitrate-N	g/m <sup>3</sup>	3.4	3.7	3.6
Nitrate-N + Nitrite-N	g/m <sup>3</sup>	3.5	3.7	3.6
Dissolved Reactive Phosphorus	g/m <sup>3</sup>	0.174	0.090	0.091

Analyst's Comments
<p>#1 Statistically estimated count based on the theoretical countable range for the stated method. Please interpret this microbiological result with caution as the sample required repeat analysis. Due to incubation times it is not possible to perform a repeat analysis within 24 hours of sampling as required by the method. Repeats are typically due to unexpected analyte levels.</p> <p>#2 Due to the nature of this sample a dilution was performed prior to analysis, resulting in a detection limit higher than that normally achieved for the NO<sub>2</sub>N analysis.</p> <p>#3 Please interpret this microbiological result with caution as the sample required repeat analysis. Due to incubation times it is not possible to perform a repeat analysis within 24 hours of sampling as required by the method. Repeats are typically due to unexpected analyte levels.</p>

# Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Labs, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-3
Total Digestion	Nitric acid digestion. APHA 3030 E (modified) : Online Edition.	-	1-3
Turbidity	Analysis by Turbidity meter. APHA 2130 B (modified) : Online Edition.	0.05 NTU	1-3
pH	pH meter. APHA 4500-H <sup>+</sup> B (modified) : Online Edition. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-3
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B : Online Edition.	0.1 mS/m	1-3
Total Sodium	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B : Online Edition.	0.42 g/m <sup>3</sup>	1-3
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m <sup>3</sup>	1-3
Total Nitrogen	Calculation: TKN + Nitrate-N + Nitrite-N. Please note: The Default Detection Limit of 0.05 g/m <sup>3</sup> is only attainable when the TKN has been determined using a trace method utilising duplicate analyses. In cases where the Detection Limit for TKN is 0.10 g/m <sup>3</sup> , the Default Detection Limit for Total Nitrogen will be 0.11 g/m <sup>3</sup> . In-house calculation.	0.05 g/m <sup>3</sup>	1-3
Total Ammoniacal-N	Phenol/hypochlorite colourimetry. Flow injection analyser. (NH <sub>4</sub> -N = NH <sub>4</sub> <sup>+</sup> -N + NH <sub>3</sub> -N). APHA 4500-NH <sub>3</sub> H (modified) : Online Edition.	0.010 g/m <sup>3</sup>	1-3
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO <sub>3</sub> <sup>-</sup> I (modified) : Online Edition.	0.002 g/m <sup>3</sup>	1-3
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - Nitrite-N. In-House.	0.0010 g/m <sup>3</sup>	1-3
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO <sub>3</sub> <sup>-</sup> I (modified) : Online Edition.	0.002 g/m <sup>3</sup>	1-3
Total Kjeldahl Nitrogen (TKN)	Total Kjeldahl digestion, phenol/hypochlorite colorimetry. Discrete Analyser. APHA 4500-N <sub>org</sub> D (modified) 4500 NH <sub>3</sub> F (modified) : Online Edition.	0.10 g/m <sup>3</sup>	1-3
Total Organic Nitrogen (TON)	Calculation: TKN - NH <sub>4</sub> -N. In-house calculation.	0.10 g/m <sup>3</sup>	1-3
Dissolved Reactive Phosphorus	Filtered sample. Molybdenum blue colourimetry. Flow injection analyser. APHA 4500-P G (modified) : Online Edition.	0.004 g/m <sup>3</sup>	1-3
Total Phosphorus	Total phosphorus digestion, automated ascorbic acid colorimetry. Flow Injection Analyser. APHA 4500-P H (modified) : Online Edition.	0.002 g/m <sup>3</sup>	1-3
Carbonaceous Biochemical Oxygen Demand (cBOD <sub>5</sub> )	Incubation 5 days, DO meter, nitrification inhibitor added, seeded. APHA 5210 B (modified) : Online Edition.	2 g O <sub>2</sub> /m <sup>3</sup>	1-3
Chlorophyll a	Acetone extraction. Spectroscopy. APHA 10200 H (modified) : Online Edition.	0.003 g/m <sup>3</sup>	1-3
Nutrient Profile		0.0010 - 0.010 g/m <sup>3</sup>	1-3
Faecal Coliforms and E. coli profile			
Faecal Coliforms	Membrane Filtration, Count on CCA agar, Incubated at 44.5°C for 21-24 hours. APHA 9222 D (modified) : Online Edition.	1 cfu / 100mL	1-3
Escherichia coli	Membrane filtration, Count on CCA agar, Incubated at 44.5°C for 21-24 hours. APHA 9222 I (modified) : Online Edition.	1 cfu / 100mL	1-3

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 06-May-2024 and 10-May-2024. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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A handwritten signature in blue ink, consisting of several overlapping, stylized strokes that form a unique, illegible mark.

Ara Heron BSc (Tech)  
Client Services Manager - Environmental

## Certificate of Analysis

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<b>Client:</b>	Pattle Delamore Partners Limited	<b>Lab No:</b>	3570064	SPV2
<b>Contact:</b>	Kimberly Murphy C/- Pattle Delamore Partners Limited PO Box 9528 Newmarket Auckland 1149	<b>Date Received:</b>	04-May-2024	
		<b>Date Reported:</b>	15-May-2024	
		<b>Quote No:</b>	130161	
		<b>Order No:</b>		
		<b>Client Reference:</b>		
		<b>Submitted By:</b>	Kimberly Murphy	

Sample Type: Aqueous					
Sample Name:	Inlet 03-May-2024 8:35 am	Outlet 03-May-2024 9:00 am	A Bottom 03-May-2024 9:30 am	B Bottom 03-May-2024 10:05 am	
Lab Number:	3570064.1	3570064.2	3570064.3	3570064.4	
Individual Tests					
Turbidity	NTU	106	2.0	10.7	116
pH	pH Units	7.0	7.9	7.9	7.3
Electrical Conductivity (EC)	mS/m	27.9	177.9	163.1	153.9
Total Sodium	g/m <sup>3</sup>	38	270	260	250
Chloride	g/m <sup>3</sup>	64	410	370	360
Total Nitrogen	g/m <sup>3</sup>	0.37	3.3	2.6	3.4
Total Kjeldahl Nitrogen (TKN)	g/m <sup>3</sup>	0.36	1.02	0.71	1.24
Total Organic Nitrogen (TON)	g/m <sup>3</sup>	0.36	0.91	0.70	1.22
Total Phosphorus	g/m <sup>3</sup>	0.36	0.26	0.44	1.30
Carbonaceous Biochemical Oxygen Demand (cBOD <sub>5</sub> )	g O <sub>2</sub> /m <sup>3</sup>	7	< 2	< 2	< 2
Chlorophyll a	g/m <sup>3</sup>	0.128 #4	< 0.003	< 0.003	< 0.003
Faecal Coliforms and E. coli profile					
Faecal Coliforms	cfu / 100mL	10 #1	150 #1	1,000 #2	280 #3
Escherichia coli	cfu / 100mL	10 #1	100 #1	1,000 #2	260 #3
Nutrient Profile					
Total Ammoniacal-N	g/m <sup>3</sup>	< 0.010	0.112	0.013	0.023
Nitrite-N	g/m <sup>3</sup>	< 0.002	< 0.10	< 0.10	< 0.10
Nitrate-N	g/m <sup>3</sup>	0.006	2.2	1.88	2.1
Nitrate-N + Nitrite-N	g/m <sup>3</sup>	0.006	2.3	1.88	2.1
Dissolved Reactive Phosphorus	g/m <sup>3</sup>	< 0.004	0.186	0.31	0.179

### Analyst's Comments

- #1 Statistically estimated count based on the theoretical countable range for the stated method. Please interpret this microbiological result with caution as the sample required repeat analysis. Due to incubation times it is not possible to perform a repeat analysis within 24 hours of sampling as required by the method. Repeats are typically due to unexpected analyte levels.
- #2 Statistically estimated count based on the theoretical countable range for the stated method.
- #3 Please interpret this microbiological result with caution as the sample required repeat analysis. Due to incubation times it is not possible to perform a repeat analysis within 24 hours of sampling as required by the method. Repeats are typically due to unexpected analyte levels.
- #4 Due to the nature of the sample it was very difficult to homogenise the sample resulting the different results on the final reading for the Chlorophyll A analysis. The result for this sample should be treated with caution.



# Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Labs, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-4
Total Digestion	Nitric acid digestion. APHA 3030 E (modified) : Online Edition.	-	1-4
Turbidity	Analysis by Turbidity meter. APHA 2130 B (modified) : Online Edition.	0.05 NTU	1-4
pH	pH meter. APHA 4500-H <sup>+</sup> B (modified) : Online Edition. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-4
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B : Online Edition.	0.1 mS/m	1-4
Total Sodium	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B : Online Edition.	0.42 g/m <sup>3</sup>	1-4
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m <sup>3</sup>	1-4
Total Nitrogen	Calculation: TKN + Nitrate-N + Nitrite-N. Please note: The Default Detection Limit of 0.05 g/m <sup>3</sup> is only attainable when the TKN has been determined using a trace method utilising duplicate analyses. In cases where the Detection Limit for TKN is 0.10 g/m <sup>3</sup> , the Default Detection Limit for Total Nitrogen will be 0.11 g/m <sup>3</sup> . In-house calculation.	0.05 g/m <sup>3</sup>	1-4
Total Ammoniacal-N	Phenol/hypochlorite colourimetry. Flow injection analyser. (NH <sub>4</sub> -N = NH <sub>4</sub> <sup>+</sup> -N + NH <sub>3</sub> -N). APHA 4500-NH <sub>3</sub> H (modified) : Online Edition.	0.010 g/m <sup>3</sup>	1-4
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO <sub>3</sub> <sup>-</sup> I (modified) : Online Edition.	0.002 g/m <sup>3</sup>	1-4
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - Nitrite-N. In-House.	0.0010 g/m <sup>3</sup>	1-4
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO <sub>3</sub> <sup>-</sup> I (modified) : Online Edition.	0.002 g/m <sup>3</sup>	1-4
Total Kjeldahl Nitrogen (TKN)	Total Kjeldahl digestion, phenol/hypochlorite colorimetry. Discrete Analyser. APHA 4500-N <sub>org</sub> D (modified) 4500 NH <sub>3</sub> F (modified) : Online Edition.	0.10 g/m <sup>3</sup>	1-4
Total Organic Nitrogen (TON)	Calculation: TKN - NH <sub>4</sub> -N. In-house calculation.	0.10 g/m <sup>3</sup>	1-4
Dissolved Reactive Phosphorus	Filtered sample. Molybdenum blue colourimetry. Flow injection analyser. APHA 4500-P G (modified) : Online Edition.	0.004 g/m <sup>3</sup>	1-4
Total Phosphorus	Total phosphorus digestion, automated ascorbic acid colorimetry. Flow Injection Analyser. APHA 4500-P H (modified) : Online Edition.	0.002 g/m <sup>3</sup>	1-4
Carbonaceous Biochemical Oxygen Demand (cBOD <sub>5</sub> )	Incubation 5 days, DO meter, nitrification inhibitor added, seeded. APHA 5210 B (modified) : Online Edition.	2 g O <sub>2</sub> /m <sup>3</sup>	1-4
Chlorophyll a	Acetone extraction. Spectroscopy. APHA 10200 H (modified) : Online Edition.	0.003 g/m <sup>3</sup>	1-4
Nutrient Profile		0.0010 - 0.010 g/m <sup>3</sup>	1-4
Faecal Coliforms and E. coli profile			
Faecal Coliforms	Membrane Filtration, Count on CCA agar, Incubated at 44.5°C for 21-24 hours. APHA 9222 D (modified) : Online Edition.	1 cfu / 100mL	1-4
Escherichia coli	Membrane filtration, Count on CCA agar, Incubated at 44.5°C for 21-24 hours. APHA 9222 I (modified) : Online Edition.	1 cfu / 100mL	1-4

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 05-May-2024 and 15-May-2024. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Martin Cowell - BSc  
Client Services Manager - Environmental

## Certificate of Analysis

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<b>Client:</b>	Pattle Delamore Partners Limited	<b>Lab No:</b>	3574912	SPV1
<b>Contact:</b>	Kimberly Murphy	<b>Date Received:</b>	09-May-2024	
	C/- Pattle Delamore Partners Limited	<b>Date Reported:</b>	16-May-2024	
	PO Box 9528	<b>Quote No:</b>	130161	
	Newmarket	<b>Order No:</b>		
	Auckland 1149	<b>Client Reference:</b>		
		<b>Submitted By:</b>	Kimberly Murphy	

Sample Type: Aqueous					
Sample Name:		Inlet 08-May-2024 8:35 am	Outlet 08-May-2024 8:55 am	A Bottom 08-May-2024 9:20 am	C Bottom 08-May-2024 9:40 am
Lab Number:		3574912.1	3574912.2	3574912.3	3574912.4
Individual Tests					
Turbidity	NTU	27	2.6	14.2	4.7
pH	pH Units	7.3	7.9	7.9	7.9
Electrical Conductivity (EC)	mS/m	28.1	155.0	173.2	173.8
Total Sodium	g/m <sup>3</sup>	40	250	270	270
Chloride	g/m <sup>3</sup>	62	350	390	390
Total Nitrogen	g/m <sup>3</sup>	0.38	3.0	4.0	4.4
Total Kjeldahl Nitrogen (TKN)	g/m <sup>3</sup>	0.38	0.9	1.29	1.01
Total Organic Nitrogen (TON)	g/m <sup>3</sup>	0.37	0.9	1.26	0.97
Total Phosphorus	g/m <sup>3</sup>	0.121	0.23	0.33	0.175
Carbonaceous Biochemical Oxygen Demand (cBOD <sub>5</sub> )	g O <sub>2</sub> /m <sup>3</sup>	< 2 #2	< 2 #2	< 2 #2	< 2 #2
Faecal Coliforms and E. coli profile					
Faecal Coliforms	cfu / 100mL	< 1,000 #1	< 1,000 #1	< 1,000 #1	< 1,000 #1
Escherichia coli	cfu / 100mL	< 1,000 #1	< 1,000 #1	< 1,000 #1	< 1,000 #1
Nutrient Profile					
Total Ammoniacal-N	g/m <sup>3</sup>	< 0.010	0.090	0.030	0.037
Nitrite-N	g/m <sup>3</sup>	< 0.002	0.025	0.003	0.004
Nitrate-N	g/m <sup>3</sup>	< 0.002	2.0	2.7	3.4
Nitrate-N + Nitrite-N	g/m <sup>3</sup>	< 0.002	2.1	2.7	3.4
Dissolved Reactive Phosphorus	g/m <sup>3</sup>	0.008	0.160	0.160	0.106

Analyst's Comments
#1 Statistically estimated count based on the theoretical countable range for the stated method.
#2 Due to unexpected sample numbers and limited resources, we were unable to commence the carbonaceous Biochemical Oxygen Demand (cBOD <sub>5</sub> ) analysis on the day that the sample arrived at the laboratory. The analysis was performed, as soon as possible, on the frozen sample.

## Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Labs, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-4
Total Digestion	Nitric acid digestion. APHA 3030 E (modified) : Online Edition.	-	1-4



This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised. The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked \* or any comments and interpretations, which are not accredited.



Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Turbidity	Analysis by Turbidity meter. APHA 2130 B (modified) : Online Edition.	0.05 NTU	1-4
pH	pH meter. APHA 4500-H <sup>+</sup> B (modified) : Online Edition. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-4
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B : Online Edition.	0.1 mS/m	1-4
Total Sodium	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B : Online Edition.	0.42 g/m <sup>3</sup>	1-4
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m <sup>3</sup>	1-4
Total Nitrogen	Calculation: TKN + Nitrate-N + Nitrite-N. Please note: The Default Detection Limit of 0.05 g/m <sup>3</sup> is only attainable when the TKN has been determined using a trace method utilising duplicate analyses. In cases where the Detection Limit for TKN is 0.10 g/m <sup>3</sup> , the Default Detection Limit for Total Nitrogen will be 0.11 g/m <sup>3</sup> . In-house calculation.	0.05 g/m <sup>3</sup>	1-4
Total Ammoniacal-N	Phenol/hypochlorite colourimetry. Flow injection analyser. (NH <sub>4</sub> -N = NH <sub>4</sub> <sup>+</sup> -N + NH <sub>3</sub> -N). APHA 4500-NH <sub>3</sub> H (modified) : Online Edition.	0.010 g/m <sup>3</sup>	1-4
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO <sub>3</sub> <sup>-</sup> I (modified) : Online Edition.	0.002 g/m <sup>3</sup>	1-4
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - Nitrite-N. In-House.	0.0010 g/m <sup>3</sup>	1-4
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO <sub>3</sub> <sup>-</sup> I (modified) : Online Edition.	0.002 g/m <sup>3</sup>	1-4
Total Kjeldahl Nitrogen (TKN)	Total Kjeldahl digestion, phenol/hypochlorite colorimetry. Discrete Analyser. APHA 4500-N <sub>org</sub> D (modified) 4500 NH <sub>3</sub> F (modified) : Online Edition.	0.10 g/m <sup>3</sup>	1-4
Total Organic Nitrogen (TON)	Calculation: TKN - NH <sub>4</sub> -N. In-house calculation.	0.10 g/m <sup>3</sup>	1-4
Dissolved Reactive Phosphorus	Filtered sample. Molybdenum blue colourimetry. Flow injection analyser. APHA 4500-P G (modified) : Online Edition.	0.004 g/m <sup>3</sup>	1-4
Total Phosphorus	Total phosphorus digestion, automated ascorbic acid colorimetry. Flow Injection Analyser. APHA 4500-P H (modified) : Online Edition.	0.002 g/m <sup>3</sup>	1-4
Carbonaceous Biochemical Oxygen Demand (cBOD <sub>5</sub> )	Incubation 5 days, DO meter, nitrification inhibitor added, seeded. APHA 5210 B (modified) : Online Edition.	2 g O <sub>2</sub> /m <sup>3</sup>	1-4
Nutrient Profile		0.0010 - 0.010 g/m <sup>3</sup>	1-4
Faecal Coliforms and E. coli profile			
Faecal Coliforms	Membrane Filtration, Count on CCA agar, Incubated at 44.5°C for 21-24 hours. APHA 9222 D (modified) : Online Edition.	1 cfu / 100mL	1-4
Escherichia coli	Membrane filtration, Count on CCA agar, Incubated at 44.5°C for 21-24 hours. APHA 9222 I (modified) : Online Edition.	1 cfu / 100mL	1-4

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 10-May-2024 and 16-May-2024. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Ara Heron BSc (Tech)  
Client Services Manager - Environmental

## Certificate of Analysis

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<b>Client:</b>	Pattle Delamore Partners Limited	<b>Lab No:</b>	3574922	SPV1
<b>Contact:</b>	Kimberly Murphy C/- Pattle Delamore Partners Limited PO Box 9528 Newmarket Auckland 1149	<b>Date Received:</b>	09-May-2024	
		<b>Date Reported:</b>	16-May-2024	
		<b>Quote No:</b>	130161	
		<b>Order No:</b>		
		<b>Client Reference:</b>		
		<b>Submitted By:</b>	Kimberly Murphy	

Sample Type: Aqueous				
Sample Name:	B Bottom 08-May-2024 9:50 am	A Top 08-May-2024 10:10 am	A Top Repeat 08-May-2024 10:10 am	
Lab Number:	3574922.1	3574922.2	3574922.3	
Individual Tests				
Turbidity	NTU	4.1	1.31	1.45
pH	pH Units	7.8	7.8	7.8
Electrical Conductivity (EC)	mS/m	169.8	173.1	174.5
Total Sodium	g/m <sup>3</sup>	270	280	290
Chloride	g/m <sup>3</sup>	390	400	390
Total Nitrogen	g/m <sup>3</sup>	3.5	4.4	4.7
Total Kjeldahl Nitrogen (TKN)	g/m <sup>3</sup>	0.85	1.07	1.18
Total Organic Nitrogen (TON)	g/m <sup>3</sup>	0.83	1.02	1.14
Total Phosphorus	g/m <sup>3</sup>	0.20	0.122	0.126
Carbonaceous Biochemical Oxygen Demand (cBOD <sub>5</sub> )	g O <sub>2</sub> /m <sup>3</sup>	< 2 #2	< 2 #2	< 2 #2
Faecal Coliforms and E. coli profile				
Faecal Coliforms	cfu / 100mL	150 #1	20 #1	20 #1
Escherichia coli	cfu / 100mL	140 #1	10 #1	20 #1
Nutrient Profile				
Total Ammoniacal-N	g/m <sup>3</sup>	0.026	0.047	0.043
Nitrite-N	g/m <sup>3</sup>	0.002	0.006	0.006
Nitrate-N	g/m <sup>3</sup>	2.7	3.4	3.5
Nitrate-N + Nitrite-N	g/m <sup>3</sup>	2.7	3.4	3.5
Dissolved Reactive Phosphorus	g/m <sup>3</sup>	0.132	0.033	0.040

Analyst's Comments
#1 Statistically estimated count based on the theoretical countable range for the stated method.
#2 Due to unexpected sample numbers and limited resources, we were unable to commence the carbonaceous Biochemical Oxygen Demand (cBOD <sub>5</sub> ) analysis on the day that the sample arrived at the laboratory. The analysis was performed, as soon as possible, on the frozen sample.

## Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Labs, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-3
Total Digestion	Nitric acid digestion. APHA 3030 E (modified) : Online Edition.	-	1-3



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Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Turbidity	Analysis by Turbidity meter. APHA 2130 B (modified) : Online Edition.	0.05 NTU	1-3
pH	pH meter. APHA 4500-H <sup>+</sup> B (modified) : Online Edition. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-3
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B : Online Edition.	0.1 mS/m	1-3
Total Sodium	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B : Online Edition.	0.42 g/m <sup>3</sup>	1-3
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m <sup>3</sup>	1-3
Total Nitrogen	Calculation: TKN + Nitrate-N + Nitrite-N. Please note: The Default Detection Limit of 0.05 g/m <sup>3</sup> is only attainable when the TKN has been determined using a trace method utilising duplicate analyses. In cases where the Detection Limit for TKN is 0.10 g/m <sup>3</sup> , the Default Detection Limit for Total Nitrogen will be 0.11 g/m <sup>3</sup> . In-house calculation.	0.05 g/m <sup>3</sup>	1-3
Total Ammoniacal-N	Phenol/hypochlorite colourimetry. Flow injection analyser. (NH <sub>4</sub> -N = NH <sub>4</sub> <sup>+</sup> -N + NH <sub>3</sub> -N). APHA 4500-NH <sub>3</sub> H (modified) : Online Edition.	0.010 g/m <sup>3</sup>	1-3
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO <sub>3</sub> <sup>-</sup> I (modified) : Online Edition.	0.002 g/m <sup>3</sup>	1-3
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - Nitrite-N. In-House.	0.0010 g/m <sup>3</sup>	1-3
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO <sub>3</sub> <sup>-</sup> I (modified) : Online Edition.	0.002 g/m <sup>3</sup>	1-3
Total Kjeldahl Nitrogen (TKN)	Total Kjeldahl digestion, phenol/hypochlorite colorimetry. Discrete Analyser. APHA 4500-N <sub>org</sub> D (modified) 4500 NH <sub>3</sub> F (modified) : Online Edition.	0.10 g/m <sup>3</sup>	1-3
Total Organic Nitrogen (TON)	Calculation: TKN - NH <sub>4</sub> -N. In-house calculation.	0.10 g/m <sup>3</sup>	1-3
Dissolved Reactive Phosphorus	Filtered sample. Molybdenum blue colourimetry. Flow injection analyser. APHA 4500-P G (modified) : Online Edition.	0.004 g/m <sup>3</sup>	1-3
Total Phosphorus	Total phosphorus digestion, automated ascorbic acid colorimetry. Flow Injection Analyser. APHA 4500-P H (modified) : Online Edition.	0.002 g/m <sup>3</sup>	1-3
Carbonaceous Biochemical Oxygen Demand (cBOD <sub>5</sub> )	Incubation 5 days, DO meter, nitrification inhibitor added, seeded. APHA 5210 B (modified) : Online Edition.	2 g O <sub>2</sub> /m <sup>3</sup>	1-3
Nutrient Profile		0.0010 - 0.010 g/m <sup>3</sup>	1-3
Faecal Coliforms and E. coli profile			
Faecal Coliforms	Membrane Filtration, Count on CCA agar, Incubated at 44.5°C for 21-24 hours. APHA 9222 D (modified) : Online Edition.	1 cfu / 100mL	1-3
Escherichia coli	Membrane filtration, Count on CCA agar, Incubated at 44.5°C for 21-24 hours. APHA 9222 I (modified) : Online Edition.	1 cfu / 100mL	1-3

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 10-May-2024 and 16-May-2024. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Ara Heron BSc (Tech)  
Client Services Manager - Environmental

## Certificate of Analysis

Page 1 of 3

<b>Client:</b>	Pattle Delamore Partners Limited	<b>Lab No:</b>	3581245	SPV1
<b>Contact:</b>	Kimberly Murphy C/- Pattle Delamore Partners Limited PO Box 9528 Newmarket Auckland 1149	<b>Date Received:</b>	15-May-2024	
		<b>Date Reported:</b>	23-May-2024	
		<b>Quote No:</b>	130161	
		<b>Order No:</b>		
		<b>Client Reference:</b>	A028030001	
		<b>Submitted By:</b>	Kimberly Murphy	

### Sample Type: Aqueous

Sample Name:	Inlet 14-May-2024 8:50 am	Outlet 14-May-2024 9:10 am	A bottom 14-May-2024 9:30 am	C bottom 14-May-2024 9:50 am	B bottom 14-May-2024 10:00 am
<b>Lab Number:</b>	3581245.1	3581245.2	3581245.3	3581245.4	3581245.5

#### Individual Tests

Parameter	Units	Inlet 14-May-2024 8:50 am	Outlet 14-May-2024 9:10 am	A bottom 14-May-2024 9:30 am	C bottom 14-May-2024 9:50 am	B bottom 14-May-2024 10:00 am
Turbidity	NTU	22	2.1	6.0	4.9	12.1
pH	pH Units	6.6	7.5	7.6	7.7	7.5
Electrical Conductivity (EC)	mS/m	25.3	218	254	257	250
Total Sodium	g/m <sup>3</sup>	36	360	420	420	410
Chloride	g/m <sup>3</sup>	57	570	670	710	870
Total Nitrogen	g/m <sup>3</sup>	0.19	3.0	3.1	4.0	3.6
Total Kjeldahl Nitrogen (TKN)	g/m <sup>3</sup>	0.19	0.66	0.79	0.97	0.91
Total Organic Nitrogen (TON)	g/m <sup>3</sup>	0.19	0.58	0.77	0.95	0.88
Total Phosphorus	g/m <sup>3</sup>	0.078	0.159	0.21	0.194	0.31
Carbonaceous Biochemical Oxygen Demand (cBOD <sub>5</sub> )	g O <sub>2</sub> /m <sup>3</sup>	5	< 2	< 2	< 2	< 2

#### Faecal Coliforms and E. coli profile

Parameter	Units	Inlet 14-May-2024 8:50 am	Outlet 14-May-2024 9:10 am	A bottom 14-May-2024 9:30 am	C bottom 14-May-2024 9:50 am	B bottom 14-May-2024 10:00 am
Faecal Coliforms	cfu / 100mL	420 #1	300	100 #2	300 #2	270
Escherichia coli	cfu / 100mL	390 #1	300	100 #2	300 #2	260

#### Nutrient Profile

Parameter	Units	Inlet 14-May-2024 8:50 am	Outlet 14-May-2024 9:10 am	A bottom 14-May-2024 9:30 am	C bottom 14-May-2024 9:50 am	B bottom 14-May-2024 10:00 am
Total Ammoniacal-N	g/m <sup>3</sup>	< 0.010	0.082	0.026	0.022	0.032
Nitrite-N	g/m <sup>3</sup>	< 0.002	< 0.10	< 0.10	< 0.10 #3	< 0.10 #3
Nitrate-N	g/m <sup>3</sup>	< 0.002	2.3	2.3	3.0	2.7
Nitrate-N + Nitrite-N	g/m <sup>3</sup>	< 0.002	2.4	2.3	3.1	2.7
Dissolved Reactive Phosphorus	g/m <sup>3</sup>	0.005	0.099	0.142	0.108	0.122

Sample Name:	B top 14-May-2024 10:15 am	B top repeat 14-May-2024 10:15 am
<b>Lab Number:</b>	3581245.6	3581245.7

#### Individual Tests

Parameter	Units	B top 14-May-2024 10:15 am	B top repeat 14-May-2024 10:15 am
Turbidity	NTU	1.18	1.21
pH	pH Units	7.1	7.2
Electrical Conductivity (EC)	mS/m	259	258
Total Sodium	g/m <sup>3</sup>	430	400
Chloride	g/m <sup>3</sup>	950	720
Total Nitrogen	g/m <sup>3</sup>	4.1	4.2
Total Kjeldahl Nitrogen (TKN)	g/m <sup>3</sup>	1.14	1.21
Total Organic Nitrogen (TON)	g/m <sup>3</sup>	1.10	1.17
Total Phosphorus	g/m <sup>3</sup>	0.20	0.21
Carbonaceous Biochemical Oxygen Demand (cBOD <sub>5</sub> )	g O <sub>2</sub> /m <sup>3</sup>	< 2	< 2



Sample Type: Aqueous			
<b>Sample Name:</b>		B top 14-May-2024 10:15 am	B top repeat 14-May-2024 10:15 am
<b>Lab Number:</b>		3581245.6	3581245.7
Faecal Coliforms and E. coli profile			
Faecal Coliforms	cfu / 100mL	< 100 #2	< 100 #2
Escherichia coli	cfu / 100mL	< 100 #2	< 100 #2
Nutrient Profile			
Total Ammoniacal-N	g/m <sup>3</sup>	0.040	0.040
Nitrite-N	g/m <sup>3</sup>	< 0.10 #3	< 0.10 #3
Nitrate-N	g/m <sup>3</sup>	2.9	3.0
Nitrate-N + Nitrite-N	g/m <sup>3</sup>	3.0	3.0
Dissolved Reactive Phosphorus	g/m <sup>3</sup>	0.097	0.098

### Analyst's Comments

#1 Please interpret this microbiological result with caution as the sample was > 24 hours old at the time of testing in the laboratory. The sample is required to reach the laboratory with sufficient time to allow testing to commence within 24 hours of sampling.

#2 Statistically estimated count based on the theoretical countable range for the stated method.

#3 Due to the nature of this sample a dilution was performed prior to analysis, resulting in a detection limit higher than that normally achieved for the NO<sub>2</sub>N analysis.

## Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Labs, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-7
Total Digestion	Nitric acid digestion. APHA 3030 E (modified) : Online Edition.	-	1-7
Turbidity	Analysis by Turbidity meter. APHA 2130 B (modified) : Online Edition.	0.05 NTU	1-7
pH	pH meter. APHA 4500-H+ B (modified) : Online Edition. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-7
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B : Online Edition.	0.1 mS/m	1-7
Total Sodium	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B : Online Edition.	0.42 g/m <sup>3</sup>	1-7
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m <sup>3</sup>	1-7
Total Nitrogen	Calculation: TKN + Nitrate-N + Nitrite-N. Please note: The Default Detection Limit of 0.05 g/m <sup>3</sup> is only attainable when the TKN has been determined using a trace method utilising duplicate analyses. In cases where the Detection Limit for TKN is 0.10 g/m <sup>3</sup> , the Default Detection Limit for Total Nitrogen will be 0.11 g/m <sup>3</sup> . In-house calculation.	0.05 g/m <sup>3</sup>	1-7
Total Ammoniacal-N	Phenol/hypochlorite colourimetry. Flow injection analyser. (NH <sub>4</sub> -N = NH <sub>4</sub> <sup>+</sup> -N + NH <sub>3</sub> -N). APHA 4500-NH <sub>3</sub> H (modified) : Online Edition.	0.010 g/m <sup>3</sup>	1-7
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO <sub>2</sub> <sup>-</sup> I (modified) : Online Edition.	0.002 g/m <sup>3</sup>	1-7
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - Nitrite-N. In-House.	0.0010 g/m <sup>3</sup>	1-7
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO <sub>3</sub> <sup>-</sup> I (modified) : Online Edition.	0.002 g/m <sup>3</sup>	1-7
Total Kjeldahl Nitrogen (TKN)	Total Kjeldahl digestion, phenol/hypochlorite colorimetry. Discrete Analyser. APHA 4500-N <sub>org</sub> D (modified) 4500 NH <sub>3</sub> F (modified) : Online Edition.	0.10 g/m <sup>3</sup>	1-7
Total Organic Nitrogen (TON)	Calculation: TKN - NH <sub>4</sub> -N. In-house calculation.	0.10 g/m <sup>3</sup>	1-7

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Dissolved Reactive Phosphorus	Filtered sample. Molybdenum blue colourimetry. Flow injection analyser. APHA 4500-P G (modified) : Online Edition.	0.004 g/m <sup>3</sup>	1-7
Total Phosphorus	Total phosphorus digestion, automated ascorbic acid colorimetry. Flow Injection Analyser. APHA 4500-P H (modified) : Online Edition.	0.002 g/m <sup>3</sup>	1-7
Carbonaceous Biochemical Oxygen Demand (cBOD <sub>5</sub> )	Incubation 5 days, DO meter, nitrification inhibitor added, seeded. APHA 5210 B (modified) : Online Edition.	2 g O <sub>2</sub> /m <sup>3</sup>	1-7
Nutrient Profile		0.0010 - 0.010 g/m <sup>3</sup>	1-7
Faecal Coliforms and E. coli profile			
Faecal Coliforms	Membrane Filtration, Count on CCA agar, Incubated at 44.5°C for 21-24 hours. APHA 9222 D (modified) : Online Edition.	1 cfu / 100mL	1-7
Escherichia coli	Membrane filtration, Count on CCA agar, Incubated at 44.5°C for 21-24 hours. APHA 9222 I (modified) : Online Edition.	1 cfu / 100mL	1-7

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 16-May-2024 and 23-May-2024. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Kim Harrison MSc  
Client Services Manager - Environmental

## Certificate of Analysis

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<b>Client:</b>	Pattle Delamore Partners Limited	<b>Lab No:</b>	3588982	SPV1
<b>Contact:</b>	Kimberly Murphy	<b>Date Received:</b>	23-May-2024	
	C/- Pattle Delamore Partners Limited	<b>Date Reported:</b>	31-May-2024	
	PO Box 9528	<b>Quote No:</b>	130161	
	Newmarket	<b>Order No:</b>		
	Auckland 1149	<b>Client Reference:</b>	A028030001	
		<b>Submitted By:</b>	Kimberly Murphy	

### Sample Type: Aqueous

Sample Name:	Inlet 22-May-2024 8:30 am	Outlet 22-May-2024 8:40 am	A Bottom 22-May-2024 9:00 am	B Bottom 22-May-2024 9:30 am	C Bottom 22-May-2024 9:20 am
<b>Lab Number:</b>	3588982.1	3588982.2	3588982.3	3588982.4	3588982.5

#### Individual Tests

Parameter	Units	Inlet 22-May-2024 8:30 am	Outlet 22-May-2024 8:40 am	A Bottom 22-May-2024 9:00 am	B Bottom 22-May-2024 9:30 am	C Bottom 22-May-2024 9:20 am
Turbidity	NTU	8.7	4.9	10.1	7.7	5.6
pH	pH Units	6.6	7.7	7.8	7.7	7.7
Electrical Conductivity (EC)	mS/m	21.5	131.5	134.9	128.8	131.1
Total Sodium	g/m <sup>3</sup>	29	220	230	210	210
Chloride	g/m <sup>3</sup>	46	300	300	290	300
Total Nitrogen	g/m <sup>3</sup>	0.38	3.9	4.8	4.6	5.5
Total Kjeldahl Nitrogen (TKN)	g/m <sup>3</sup>	0.33	0.91	0.93	0.85	0.94
Total Organic Nitrogen (TON)	g/m <sup>3</sup>	0.31	0.81	0.89	0.83	0.90
Total Phosphorus	g/m <sup>3</sup>	0.035	0.23	0.35	0.36	0.33
Carbonaceous Biochemical Oxygen Demand (cBOD <sub>5</sub> )	g O <sub>2</sub> /m <sup>3</sup>	< 2	< 2	< 2	< 2	< 2

#### Faecal Coliforms and E. coli profile

Parameter	Units	Inlet 22-May-2024 8:30 am	Outlet 22-May-2024 8:40 am	A Bottom 22-May-2024 9:00 am	B Bottom 22-May-2024 9:30 am	C Bottom 22-May-2024 9:20 am
Faecal Coliforms	cfu / 100mL	140 #1	460	50 #1	30 #1	40 #1
Escherichia coli	cfu / 100mL	140 #1	460	50 #1	30 #1	30 #1

#### Nutrient Profile

Parameter	Units	Inlet 22-May-2024 8:30 am	Outlet 22-May-2024 8:40 am	A Bottom 22-May-2024 9:00 am	B Bottom 22-May-2024 9:30 am	C Bottom 22-May-2024 9:20 am
Total Ammoniacal-N	g/m <sup>3</sup>	0.013	0.102	0.042	0.020	0.041
Nitrite-N	g/m <sup>3</sup>	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Nitrate-N	g/m <sup>3</sup>	< 0.10	3.0	3.8	3.7	4.5
Nitrate-N + Nitrite-N	g/m <sup>3</sup>	< 0.10	3.0	3.9	3.8	4.5
Dissolved Reactive Phosphorus	g/m <sup>3</sup>	0.006	0.17	0.3	0.24	0.25

Sample Name:	A Top 22-May-2024 9:40 am	A Top Retreat 22-May-2024 9:40 am
<b>Lab Number:</b>	3588982.6	3588982.7

#### Individual Tests

Parameter	Units	A Top 22-May-2024 9:40 am	A Top Retreat 22-May-2024 9:40 am
Turbidity	NTU	1.14	1.23
pH	pH Units	7.4	7.1
Electrical Conductivity (EC)	mS/m	130.8	130.1
Total Sodium	g/m <sup>3</sup>	220	210
Chloride	g/m <sup>3</sup>	290	290
Total Nitrogen	g/m <sup>3</sup>	5.8	5.9
Total Kjeldahl Nitrogen (TKN)	g/m <sup>3</sup>	1.03	1.16
Total Organic Nitrogen (TON)	g/m <sup>3</sup>	0.99	1.12
Total Phosphorus	g/m <sup>3</sup>	0.35	0.37
Carbonaceous Biochemical Oxygen Demand (cBOD <sub>5</sub> )	g O <sub>2</sub> /m <sup>3</sup>	< 2	< 2

Sample Type: Aqueous			
<b>Sample Name:</b>		A Top 22-May-2024 9:40 am	A Top Retreat 22-May-2024 9:40 am
<b>Lab Number:</b>		3588982.6	3588982.7
Faecal Coliforms and E. coli profile			
Faecal Coliforms	cfu / 100mL	< 10 #1	< 10 #1
Escherichia coli	cfu / 100mL	< 10 #1	< 10 #1
Nutrient Profile			
Total Ammoniacal-N	g/m <sup>3</sup>	0.044	0.036
Nitrite-N	g/m <sup>3</sup>	0.11	0.11
Nitrate-N	g/m <sup>3</sup>	4.7	4.6
Nitrate-N + Nitrite-N	g/m <sup>3</sup>	4.8	4.7
Dissolved Reactive Phosphorus	g/m <sup>3</sup>	0.23	0.22

### Analyst's Comments

#1 Statistically estimated count based on the theoretical countable range for the stated method.

## Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Labs, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-7
Total Digestion	Nitric acid digestion. APHA 3030 E (modified) : Online Edition.	-	1-7
Turbidity	Analysis by Turbidity meter. APHA 2130 B (modified) : Online Edition.	0.05 NTU	1-7
pH	pH meter. APHA 4500-H <sup>+</sup> B (modified) : Online Edition. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-7
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B : Online Edition.	0.1 mS/m	1-7
Total Sodium	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B : Online Edition.	0.42 g/m <sup>3</sup>	1-7
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m <sup>3</sup>	1-7
Total Nitrogen	Calculation: TKN + Nitrate-N + Nitrite-N. Please note: The Default Detection Limit of 0.05 g/m <sup>3</sup> is only attainable when the TKN has been determined using a trace method utilising duplicate analyses. In cases where the Detection Limit for TKN is 0.10 g/m <sup>3</sup> , the Default Detection Limit for Total Nitrogen will be 0.11 g/m <sup>3</sup> . In-house calculation.	0.05 g/m <sup>3</sup>	1-7
Total Ammoniacal-N	Phenol/hypochlorite colourimetry. Flow injection analyser. (NH <sub>4</sub> -N = NH <sub>4</sub> <sup>+</sup> -N + NH <sub>3</sub> -N). APHA 4500-NH <sub>3</sub> H (modified) : Online Edition.	0.010 g/m <sup>3</sup>	1-7
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO <sub>2</sub> -I (modified) : Online Edition.	0.002 g/m <sup>3</sup>	1-7
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - Nitrite-N. In-House.	0.0010 g/m <sup>3</sup>	1-7
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO <sub>3</sub> -I (modified) : Online Edition.	0.002 g/m <sup>3</sup>	1-7
Total Kjeldahl Nitrogen (TKN)	Total Kjeldahl digestion, phenol/hypochlorite colorimetry. Discrete Analyser. APHA 4500-N <sub>org</sub> D (modified) 4500 NH <sub>3</sub> F (modified) : Online Edition.	0.10 g/m <sup>3</sup>	1-7
Total Organic Nitrogen (TON)	Calculation: TKN - NH <sub>4</sub> -N. In-house calculation.	0.10 g/m <sup>3</sup>	1-7
Dissolved Reactive Phosphorus	Filtered sample. Molybdenum blue colourimetry. Flow injection analyser. APHA 4500-P G (modified) : Online Edition.	0.004 g/m <sup>3</sup>	1-7
Total Phosphorus	Total phosphorus digestion, automated ascorbic acid colorimetry. Flow Injection Analyser. APHA 4500-P H (modified) : Online Edition.	0.002 g/m <sup>3</sup>	1-7
Carbonaceous Biochemical Oxygen Demand (cBOD <sub>5</sub> )	Incubation 5 days, DO meter, nitrification inhibitor added, seeded. APHA 5210 B (modified) : Online Edition.	2 g O <sub>2</sub> /m <sup>3</sup>	1-7
Nutrient Profile		0.0010 - 0.010 g/m <sup>3</sup>	1-7



Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Faecal Coliforms and E. coli profile			
Faecal Coliforms	Membrane Filtration, Count on CCA agar, Incubated at 44.5°C for 21-24 hours. APHA 9222 D (modified) : Online Edition.	1 cfu / 100mL	1-7
Escherichia coli	Membrane filtration, Count on CCA agar, Incubated at 44.5°C for 21-24 hours. APHA 9222 I (modified) : Online Edition.	1 cfu / 100mL	1-7

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 24-May-2024 and 31-May-2024. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Ara Heron BSc (Tech)  
Client Services Manager - Environmental

## Certificate of Analysis

<b>Client:</b>	Pattle Delamore Partners Limited	<b>Lab No:</b>	3597185	SPV1
<b>Contact:</b>	Kimberly Murphy	<b>Date Received:</b>	01-Jun-2024	
	C/- Pattle Delamore Partners Limited	<b>Date Reported:</b>	14-Jun-2024	
	PO Box 9528	<b>Quote No:</b>	130161	
	Newmarket	<b>Order No:</b>		
	Auckland 1149	<b>Client Reference:</b>	A02803001	
		<b>Submitted By:</b>	Kimberly Murphy	

### Sample Type: Aqueous

Sample Name:	Inlet 31-May-2024 8:35 am	Outlet 31-May-2024 8:50 am	C bottom 31-May-2024 9:30 am	B bottom 31-May-2024 9:45 am	A bottom 31-May-2024 9:10 am
<b>Lab Number:</b>	3597185.1	3597185.2	3597185.3	3597185.4	3597185.5

#### Individual Tests

Parameter	Units	Inlet 31-May-2024 8:35 am	Outlet 31-May-2024 8:50 am	C bottom 31-May-2024 9:30 am	B bottom 31-May-2024 9:45 am	A bottom 31-May-2024 9:10 am
Turbidity	NTU	7.1	4.4	4.1	7.5	10.1
pH	pH Units	6.4	7.5	7.6	7.4	7.6
Electrical Conductivity (EC)	mS/m	20.0	130.9	124.9	124.0	126.5
Total Sodium	g/m <sup>3</sup>	26	193	183	185	189
Chloride	g/m <sup>3</sup>	42	290	270	280	280
Total Nitrogen	g/m <sup>3</sup>	0.22	4.2	5.5	4.9	5.7
Total Kjeldahl Nitrogen (TKN)	g/m <sup>3</sup>	0.20	0.81	0.94	0.91	1.42
Total Organic Nitrogen (TON)	g/m <sup>3</sup>	0.17	0.74	0.88	0.88	1.35
Total Phosphorus	g/m <sup>3</sup>	0.026	0.48	1.05	0.86	1.14
Carbonaceous Biochemical Oxygen Demand (cBOD <sub>5</sub> )	g O <sub>2</sub> /m <sup>3</sup>	< 2 #3	< 2 #3	< 2 #3	< 2 #3	< 2 #3

#### Faecal Coliforms and E. coli profile

Parameter	Units	Inlet 31-May-2024 8:35 am	Outlet 31-May-2024 8:50 am	C bottom 31-May-2024 9:30 am	B bottom 31-May-2024 9:45 am	A bottom 31-May-2024 9:10 am
Faecal Coliforms	cfu / 100mL	60 #1	100 #2	40 #2	110 #2	90 #2
Escherichia coli	cfu / 100mL	60 #1	80 #2	40 #2	110 #2	90 #2

#### Nutrient Profile

Parameter	Units	Inlet 31-May-2024 8:35 am	Outlet 31-May-2024 8:50 am	C bottom 31-May-2024 9:30 am	B bottom 31-May-2024 9:45 am	A bottom 31-May-2024 9:10 am
Total Ammoniacal-N	g/m <sup>3</sup>	0.037	0.070	0.060	0.033	0.071
Nitrite-N	g/m <sup>3</sup>	< 0.002	1.36	3.0	2.1	3.0
Nitrate-N	g/m <sup>3</sup>	0.017	2.0	1.63	1.91	1.21
Nitrate-N + Nitrite-N	g/m <sup>3</sup>	0.018	3.4	4.6	4.0	4.2
Dissolved Reactive Phosphorus	g/m <sup>3</sup>	0.007	0.39	0.91	0.73	0.90

Sample Name:	A Top 31-May-2024 9:55 am	A Top Repeat 31-May-2024 9:55 am
<b>Lab Number:</b>	3597185.6	3597185.7

#### Individual Tests

Parameter	Units	A Top 31-May-2024 9:55 am	A Top Repeat 31-May-2024 9:55 am
Turbidity	NTU	1.44	2.0
pH	pH Units	7.0	7.0
Electrical Conductivity (EC)	mS/m	124.8	122.9
Total Sodium	g/m <sup>3</sup>	191	181
Chloride	g/m <sup>3</sup>	260	270
Total Nitrogen	g/m <sup>3</sup>	5.9	5.7
Total Kjeldahl Nitrogen (TKN)	g/m <sup>3</sup>	1.25	1.10
Total Organic Nitrogen (TON)	g/m <sup>3</sup>	1.16	1.04
Total Phosphorus	g/m <sup>3</sup>	1.24	1.26
Carbonaceous Biochemical Oxygen Demand (cBOD <sub>5</sub> )	g O <sub>2</sub> /m <sup>3</sup>	< 2 #3	< 2 #3

Sample Type: Aqueous			
<b>Sample Name:</b>		A Top 31-May-2024 9:55 am	A Top Repeat 31-May-2024 9:55 am
<b>Lab Number:</b>		3597185.6	3597185.7
Faecal Coliforms and E. coli profile			
Faecal Coliforms	cfu / 100mL	< 10 #2	< 10 #2
Escherichia coli	cfu / 100mL	< 10 #2	< 10 #2
Nutrient Profile			
Total Ammoniacal-N	g/m <sup>3</sup>	0.094	0.064
Nitrite-N	g/m <sup>3</sup>	3.9	3.7
Nitrate-N	g/m <sup>3</sup>	0.82	0.89
Nitrate-N + Nitrite-N	g/m <sup>3</sup>	4.7	4.6
Dissolved Reactive Phosphorus	g/m <sup>3</sup>	0.98	0.96

### Analyst's Comments

#1 Statistically estimated count based on the theoretical countable range for the stated method. Please interpret this microbiological result with caution as the sample was > 24 hours old at the time of testing in the laboratory. The sample is required to reach the laboratory with sufficient time to allow testing to commence within 24 hours of sampling.

#2 Statistically estimated count based on the theoretical countable range for the stated method.

#3 Due to unexpected sample numbers and limited resources, we were unable to commence the carbonaceous Biochemical Oxygen Demand (cBOD5) analyses on the day that they arrived at the laboratory. The analyses were performed, as soon as possible, on the frozen samples.

### Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Labs, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-7
Total Digestion	Nitric acid digestion. APHA 3030 E (modified) : Online Edition.	-	1-7
Turbidity	Analysis by Turbidity meter. APHA 2130 B (modified) : Online Edition.	0.05 NTU	1-7
pH	pH meter. APHA 4500-H+ B (modified) : Online Edition. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-7
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B : Online Edition.	0.1 mS/m	1-7
Total Sodium	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B : Online Edition.	0.42 g/m <sup>3</sup>	1-7
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m <sup>3</sup>	1-7
Total Nitrogen	Calculation: TKN + Nitrate-N + Nitrite-N. Please note: The Default Detection Limit of 0.05 g/m <sup>3</sup> is only attainable when the TKN has been determined using a trace method utilising duplicate analyses. In cases where the Detection Limit for TKN is 0.10 g/m <sup>3</sup> , the Default Detection Limit for Total Nitrogen will be 0.11 g/m <sup>3</sup> . In-house calculation.	0.05 g/m <sup>3</sup>	1-7
Total Ammoniacal-N	Phenol/hypochlorite colourimetry. Flow injection analyser. (NH <sub>4</sub> -N = NH <sub>4</sub> <sup>+</sup> -N + NH <sub>3</sub> -N). APHA 4500-NH <sub>3</sub> H (modified) : Online Edition.	0.010 g/m <sup>3</sup>	1-7
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO <sub>3</sub> <sup>-</sup> I (modified) : Online Edition.	0.002 g/m <sup>3</sup>	1-7
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - Nitrite-N. In-House.	0.0010 g/m <sup>3</sup>	1-7
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO <sub>3</sub> <sup>-</sup> I (modified) : Online Edition.	0.002 g/m <sup>3</sup>	1-7
Total Kjeldahl Nitrogen (TKN)	Total Kjeldahl digestion, phenol/hypochlorite colorimetry. Discrete Analyser. APHA 4500-N <sub>org</sub> D (modified) 4500 NH <sub>3</sub> F (modified) : Online Edition.	0.10 g/m <sup>3</sup>	1-7
Total Organic Nitrogen (TON)	Calculation: TKN - NH <sub>4</sub> -N. In-house calculation.	0.10 g/m <sup>3</sup>	1-7

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Dissolved Reactive Phosphorus	Filtered sample. Molybdenum blue colourimetry. Flow injection analyser. APHA 4500-P G (modified) : Online Edition.	0.004 g/m <sup>3</sup>	1-7
Total Phosphorus	Total phosphorus digestion, automated ascorbic acid colorimetry. Flow Injection Analyser. APHA 4500-P H (modified) : Online Edition.	0.002 g/m <sup>3</sup>	1-7
Carbonaceous Biochemical Oxygen Demand (cBOD <sub>5</sub> )	Incubation 5 days, DO meter, nitrification inhibitor added, seeded. APHA 5210 B (modified) : Online Edition.	2 g O <sub>2</sub> /m <sup>3</sup>	1-7
Nutrient Profile		0.0010 - 0.010 g/m <sup>3</sup>	1-7
Faecal Coliforms and E. coli profile			
Faecal Coliforms	Membrane Filtration, Count on CCA agar, Incubated at 44.5°C for 21-24 hours. APHA 9222 D (modified) : Online Edition.	1 cfu / 100mL	1-7
Escherichia coli	Membrane filtration, Count on CCA agar, Incubated at 44.5°C for 21-24 hours. APHA 9222 I (modified) : Online Edition.	1 cfu / 100mL	1-7

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 02-Jun-2024 and 14-Jun-2024. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Ara Heron BSc (Tech)  
Client Services Manager - Environmental



## Certificate of Analysis

Page 1 of 2

<b>Client:</b>	Pattle Delamore Partners Limited	<b>Lab No:</b>	3602107	SPV1
<b>Contact:</b>	Kimberly Murphy	<b>Date Received:</b>	08-Jun-2024	
	C/- Pattle Delamore Partners Limited	<b>Date Reported:</b>	20-Jun-2024	
	PO Box 9528	<b>Quote No:</b>	130161	
	Newmarket	<b>Order No:</b>		
	Auckland 1149	<b>Client Reference:</b>	A028030001	
		<b>Submitted By:</b>	Kimberly Murphy	

### Sample Type: Aqueous

Sample Name:		Inlet 07-Jun-2024 8:30 am	Outlet 07-Jun-2024 8:45 am	A Bottom 07-Jun-2024 9:00 am
Lab Number:		3602107.1	3602107.2	3602107.3
Individual Tests				
Turbidity	NTU	36	3.1	11.9
pH	pH Units	6.8	7.6	7.6
Electrical Conductivity (EC)	mS/m	19.8	137.3	145.2
Total Sodium	g/m <sup>3</sup>	27	230	240
Chloride	g/m <sup>3</sup>	42	310	330
Total Nitrogen	g/m <sup>3</sup>	0.34	4.9	5.3
Total Kjeldahl Nitrogen (TKN)	g/m <sup>3</sup>	0.34	0.80	0.73
Total Organic Nitrogen (TON)	g/m <sup>3</sup>	0.33	0.73	0.70
Total Phosphorus	g/m <sup>3</sup>	0.088	0.21	0.31
Carbonaceous Biochemical Oxygen Demand (cBOD <sub>5</sub> )	g O <sub>2</sub> /m <sup>3</sup>	< 2 #2	< 2 #2	< 2 #2
Faecal Coliforms and E. coli profile				
Faecal Coliforms	cfu / 100mL	20 #1	180 #1	400
Escherichia coli	cfu / 100mL	20 #1	180 #1	400
Nutrient Profile				
Total Ammoniacal-N	g/m <sup>3</sup>	< 0.010	0.065	0.026
Nitrite-N	g/m <sup>3</sup>	< 0.002	0.083	0.166
Nitrate-N	g/m <sup>3</sup>	< 0.002	4.1	4.4
Nitrate-N + Nitrite-N	g/m <sup>3</sup>	0.002	4.1	4.5
Dissolved Reactive Phosphorus	g/m <sup>3</sup>	0.008	0.152	0.21

### Analyst's Comments

#1 Statistically estimated count based on the theoretical countable range for the stated method.

#2 Due to unexpected sample numbers and limited resources, we were unable to commence the carbonaceous Biochemical Oxygen Demand (cBOD<sub>5</sub>) analysis on the day that the sample arrived at the laboratory. The analysis was performed, as soon as possible, on the frozen sample.

## Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Labs, 28 Duke Street, Frankton, Hamilton 3204.

### Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-3
Total Digestion	Nitric acid digestion. APHA 3030 E (modified) : Online Edition.	-	1-3



This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised. The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked \* or any comments and interpretations, which are not accredited.

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Turbidity	Analysis by Turbidity meter. APHA 2130 B (modified) : Online Edition.	0.05 NTU	1-3
pH	pH meter. APHA 4500-H <sup>+</sup> B (modified) : Online Edition. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-3
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B : Online Edition.	0.1 mS/m	1-3
Total Sodium	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B : Online Edition.	0.42 g/m <sup>3</sup>	1-3
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m <sup>3</sup>	1-3
Total Nitrogen	Calculation: TKN + Nitrate-N + Nitrite-N. Please note: The Default Detection Limit of 0.05 g/m <sup>3</sup> is only attainable when the TKN has been determined using a trace method utilising duplicate analyses. In cases where the Detection Limit for TKN is 0.10 g/m <sup>3</sup> , the Default Detection Limit for Total Nitrogen will be 0.11 g/m <sup>3</sup> . In-house calculation.	0.05 g/m <sup>3</sup>	1-3
Total Ammoniacal-N	Phenol/hypochlorite colourimetry. Flow injection analyser. (NH <sub>4</sub> -N = NH <sub>4</sub> <sup>+</sup> -N + NH <sub>3</sub> -N). APHA 4500-NH <sub>3</sub> H (modified) : Online Edition.	0.010 g/m <sup>3</sup>	1-3
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO <sub>3</sub> <sup>-</sup> I (modified) : Online Edition.	0.002 g/m <sup>3</sup>	1-3
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - Nitrite-N. In-House.	0.0010 g/m <sup>3</sup>	1-3
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO <sub>3</sub> <sup>-</sup> I (modified) : Online Edition.	0.002 g/m <sup>3</sup>	1-3
Total Kjeldahl Nitrogen (TKN)	Total Kjeldahl digestion, phenol/hypochlorite colorimetry. Discrete Analyser. APHA 4500-N <sub>org</sub> D (modified) 4500 NH <sub>3</sub> F (modified) : Online Edition.	0.10 g/m <sup>3</sup>	1-3
Total Organic Nitrogen (TON)	Calculation: TKN - NH <sub>4</sub> -N. In-house calculation.	0.10 g/m <sup>3</sup>	1-3
Dissolved Reactive Phosphorus	Filtered sample. Molybdenum blue colourimetry. Flow injection analyser. APHA 4500-P G (modified) : Online Edition.	0.004 g/m <sup>3</sup>	1-3
Total Phosphorus	Total phosphorus digestion, automated ascorbic acid colorimetry. Flow Injection Analyser. APHA 4500-P H (modified) : Online Edition.	0.002 g/m <sup>3</sup>	1-3
Carbonaceous Biochemical Oxygen Demand (cBOD <sub>5</sub> )	Incubation 5 days, DO meter, nitrification inhibitor added, seeded. APHA 5210 B (modified) : Online Edition.	2 g O <sub>2</sub> /m <sup>3</sup>	1-3
Nutrient Profile		0.0010 - 0.010 g/m <sup>3</sup>	1-3
Faecal Coliforms and E. coli profile			
Faecal Coliforms	Membrane Filtration, Count on CCA agar, Incubated at 44.5°C for 21-24 hours. APHA 9222 D (modified) : Online Edition.	1 cfu / 100mL	1-3
Escherichia coli	Membrane filtration, Count on CCA agar, Incubated at 44.5°C for 21-24 hours. APHA 9222 I (modified) : Online Edition.	1 cfu / 100mL	1-3

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 09-Jun-2024 and 20-Jun-2024. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Ara Heron BSc (Tech)  
Client Services Manager - Environmental

## Certificate of Analysis

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<b>Client:</b>	Pattle Delamore Partners Limited	<b>Lab No:</b>	3602118	SPV1
<b>Contact:</b>	Kimberly Murphy	<b>Date Received:</b>	08-Jun-2024	
	C/- Pattle Delamore Partners Limited	<b>Date Reported:</b>	20-Jun-2024	
	PO Box 9528	<b>Quote No:</b>	130161	
	Newmarket	<b>Order No:</b>		
	Auckland 1149	<b>Client Reference:</b>	A028030001	
		<b>Submitted By:</b>	Kimberly Murphy	

Sample Type: Aqueous				
Sample Name:		B Bottom 07-Jun-2024 9:30 am	C Bottom 07-Jun-2024 9:20 am	
Lab Number:		3602118.1	3602118.2	
Individual Tests				
Turbidity	NTU	9.8	3.1	
pH	pH Units	7.5	7.6	
Electrical Conductivity (EC)	mS/m	144.3	146.3	
Total Sodium	g/m <sup>3</sup>	250	240	
Chloride	g/m <sup>3</sup>	330	330	
Total Nitrogen	g/m <sup>3</sup>	4.0	6.2	
Total Kjeldahl Nitrogen (TKN)	g/m <sup>3</sup>	0.64	0.76	
Total Organic Nitrogen (TON)	g/m <sup>3</sup>	0.64	0.72	
Total Phosphorus	g/m <sup>3</sup>	0.35	0.24	
Carbonaceous Biochemical Oxygen Demand (cBOD <sub>5</sub> )	g O <sub>2</sub> /m <sup>3</sup>	< 2 #2	< 2 #2	
Faecal Coliforms and E. coli profile				
Faecal Coliforms	cfu / 100mL	40 #1	10 #1	
Escherichia coli	cfu / 100mL	40 #1	10 #1	
Nutrient Profile				
Total Ammoniacal-N	g/m <sup>3</sup>	< 0.010	0.040	
Nitrite-N	g/m <sup>3</sup>	0.003	0.168	
Nitrate-N	g/m <sup>3</sup>	3.4	5.3	
Nitrate-N + Nitrite-N	g/m <sup>3</sup>	3.4	5.4	
Dissolved Reactive Phosphorus	g/m <sup>3</sup>	0.146	0.181	

Analyst's Comments	
#1	Statistically estimated count based on the theoretical countable range for the stated method.
#2	Due to unexpected sample numbers and limited resources, we were unable to commence the carbonaceous Biochemical Oxygen Demand (cBOD <sub>5</sub> ) analysis on the day that the sample arrived at the laboratory. The analysis was performed, as soon as possible, on the frozen sample.

## Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Labs, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-2
Total Digestion	Nitric acid digestion. APHA 3030 E (modified) : Online Edition.	-	1-2
Turbidity	Analysis by Turbidity meter. APHA 2130 B (modified) : Online Edition.	0.05 NTU	1-2



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Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
pH	pH meter. APHA 4500-H <sup>+</sup> B (modified) : Online Edition. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-2
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B : Online Edition.	0.1 mS/m	1-2
Total Sodium	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B : Online Edition.	0.42 g/m <sup>3</sup>	1-2
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m <sup>3</sup>	1-2
Total Nitrogen	Calculation: TKN + Nitrate-N + Nitrite-N. Please note: The Default Detection Limit of 0.05 g/m <sup>3</sup> is only attainable when the TKN has been determined using a trace method utilising duplicate analyses. In cases where the Detection Limit for TKN is 0.10 g/m <sup>3</sup> , the Default Detection Limit for Total Nitrogen will be 0.11 g/m <sup>3</sup> . In-house calculation.	0.05 g/m <sup>3</sup>	1-2
Total Ammoniacal-N	Phenol/hypochlorite colourimetry. Flow injection analyser. (NH <sub>4</sub> -N = NH <sub>4</sub> <sup>+</sup> -N + NH <sub>3</sub> -N). APHA 4500-NH <sub>3</sub> H (modified) : Online Edition.	0.010 g/m <sup>3</sup>	1-2
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO <sub>2</sub> <sup>-</sup> I (modified) : Online Edition.	0.002 g/m <sup>3</sup>	1-2
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - Nitrite-N. In-House.	0.0010 g/m <sup>3</sup>	1-2
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO <sub>3</sub> <sup>-</sup> I (modified) : Online Edition.	0.002 g/m <sup>3</sup>	1-2
Total Kjeldahl Nitrogen (TKN)	Total Kjeldahl digestion, phenol/hypochlorite colorimetry. Discrete Analyser. APHA 4500-N <sub>org</sub> D (modified) 4500 NH <sub>3</sub> F (modified) : Online Edition.	0.10 g/m <sup>3</sup>	1-2
Total Organic Nitrogen (TON)	Calculation: TKN - NH <sub>4</sub> -N. In-house calculation.	0.10 g/m <sup>3</sup>	1-2
Dissolved Reactive Phosphorus	Filtered sample. Molybdenum blue colourimetry. Flow injection analyser. APHA 4500-P G (modified) : Online Edition.	0.004 g/m <sup>3</sup>	1-2
Total Phosphorus	Total phosphorus digestion, automated ascorbic acid colorimetry. Flow Injection Analyser. APHA 4500-P H (modified) : Online Edition.	0.002 g/m <sup>3</sup>	1-2
Carbonaceous Biochemical Oxygen Demand (cBOD <sub>5</sub> )	Incubation 5 days, DO meter, nitrification inhibitor added, seeded. APHA 5210 B (modified) : Online Edition.	2 g O <sub>2</sub> /m <sup>3</sup>	1-2
Nutrient Profile		0.0010 - 0.010 g/m <sup>3</sup>	1-2
Faecal Coliforms and E. coli profile			
Faecal Coliforms	Membrane Filtration, Count on CCA agar, Incubated at 44.5°C for 21-24 hours. APHA 9222 D (modified) : Online Edition.	1 cfu / 100mL	1-2
Escherichia coli	Membrane filtration, Count on CCA agar, Incubated at 44.5°C for 21-24 hours. APHA 9222 I (modified) : Online Edition.	1 cfu / 100mL	1-2

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 09-Jun-2024 and 20-Jun-2024. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Ara Heron BSc (Tech)  
Client Services Manager - Environmental



## Certificate of Analysis

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<b>Client:</b>	Pattle Delamore Partners Limited	<b>Lab No:</b>	3605132	SPV1
<b>Contact:</b>	Kimberly Murphy	<b>Date Received:</b>	13-Jun-2024	
	C/- Pattle Delamore Partners Limited	<b>Date Reported:</b>	21-Jun-2024	
	PO Box 9528	<b>Quote No:</b>	130161	
	Newmarket	<b>Order No:</b>		
	Auckland 1149	<b>Client Reference:</b>	A028030001	
		<b>Submitted By:</b>	Kimberly Murphy	

### Sample Type: Aqueous

Sample Name:	Inlet 12-Jun-2024 8:10 am	Outlet 12-Jun-2024 8:25 am	A Bottom 12-Jun-2024 8:45 am	C Bottom 12-Jun-2024 9:05 am
<b>Lab Number:</b>	3605132.1	3605132.2	3605132.3	3605132.4

Individual Tests					
Turbidity	NTU	9.2	2.6	20	4.7
pH	pH Units	6.8	7.7	7.8	7.6
Electrical Conductivity (EC)	mS/m	19.9	142.8	150.5	153.0
Total Sodium	g/m <sup>3</sup>	26	220	230	220
Chloride	g/m <sup>3</sup>	40	310	340	340
Total Nitrogen	g/m <sup>3</sup>	0.24	4.1	5.3	5.9
Total Kjeldahl Nitrogen (TKN)	g/m <sup>3</sup>	0.24	< 1.0	< 1.0	< 1.0
Total Organic Nitrogen (TON)	g/m <sup>3</sup>	0.21	< 1.1	< 1.1	< 1.1
Total Phosphorus	g/m <sup>3</sup>	0.037	0.27	0.50	0.46
Carbonaceous Biochemical Oxygen Demand (cBOD <sub>5</sub> )	g O <sub>2</sub> /m <sup>3</sup>	< 2	< 2	< 2	< 2
Faecal Coliforms and E. coli profile					
Faecal Coliforms	cfu / 100mL	< 100 #1	100 #1	1,000 #1	< 100 #1
Escherichia coli	cfu / 100mL	< 100 #1	100 #1	1,000 #1	< 100 #1
Nutrient Profile					
Total Ammoniacal-N	g/m <sup>3</sup>	0.031	0.197	0.032	0.045
Nitrite-N	g/m <sup>3</sup>	< 0.002	0.097	0.131	0.23
Nitrate-N	g/m <sup>3</sup>	0.004	3.1	4.4	4.9
Nitrate-N + Nitrite-N	g/m <sup>3</sup>	0.006	3.2	4.5	5.1
Dissolved Reactive Phosphorus	g/m <sup>3</sup>	0.008	0.181	0.33	0.34

### Analyst's Comments

Due to unexpected sample numbers and limited resources, we were unable to commence the carbonaceous Biochemical oxygen demand (cBOD<sub>5</sub>) analyses on the day that they arrived at the laboratory. The analyses were performed, as soon as possible, on the frozen samples.

#1 Statistically estimated count based on the theoretical countable range for the stated method.

## Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Labs, 28 Duke Street, Frankton, Hamilton 3204.

### Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-4
Total Digestion	Nitric acid digestion. APHA 3030 E (modified) : Online Edition.	-	1-4
Turbidity	Analysis by Turbidity meter. APHA 2130 B (modified) : Online Edition.	0.05 NTU	1-4



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Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
pH	pH meter. APHA 4500-H <sup>+</sup> B (modified) : Online Edition. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-4
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B : Online Edition.	0.1 mS/m	1-4
Total Sodium	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B : Online Edition.	0.42 g/m <sup>3</sup>	1-4
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m <sup>3</sup>	1-4
Total Nitrogen	Calculation: TKN + Nitrate-N + Nitrite-N. Please note: The Default Detection Limit of 0.05 g/m <sup>3</sup> is only attainable when the TKN has been determined using a trace method utilising duplicate analyses. In cases where the Detection Limit for TKN is 0.10 g/m <sup>3</sup> , the Default Detection Limit for Total Nitrogen will be 0.11 g/m <sup>3</sup> . In-house calculation.	0.05 g/m <sup>3</sup>	1-4
Total Ammoniacal-N	Phenol/hypochlorite colourimetry. Flow injection analyser. (NH <sub>4</sub> -N = NH <sub>4</sub> <sup>+</sup> -N + NH <sub>3</sub> -N). APHA 4500-NH <sub>3</sub> H (modified) : Online Edition.	0.010 g/m <sup>3</sup>	1-4
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO <sub>2</sub> <sup>-</sup> I (modified) : Online Edition.	0.002 g/m <sup>3</sup>	1-4
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - Nitrite-N. In-House.	0.0010 g/m <sup>3</sup>	1-4
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO <sub>3</sub> <sup>-</sup> I (modified) : Online Edition.	0.002 g/m <sup>3</sup>	1-4
Total Kjeldahl Nitrogen (TKN)	Total Kjeldahl digestion, phenol/hypochlorite colorimetry. Discrete Analyser. APHA 4500-N <sub>org</sub> D (modified) 4500 NH <sub>3</sub> F (modified) : Online Edition.	0.10 g/m <sup>3</sup>	1-4
Total Organic Nitrogen (TON)	Calculation: TKN - NH <sub>4</sub> -N. In-house calculation.	0.10 g/m <sup>3</sup>	1-4
Dissolved Reactive Phosphorus	Filtered sample. Molybdenum blue colourimetry. Flow injection analyser. APHA 4500-P G (modified) : Online Edition.	0.004 g/m <sup>3</sup>	1-4
Total Phosphorus	Total phosphorus digestion, automated ascorbic acid colorimetry. Flow Injection Analyser. APHA 4500-P H (modified) : Online Edition.	0.002 g/m <sup>3</sup>	1-4
Carbonaceous Biochemical Oxygen Demand (cBOD <sub>5</sub> )	Incubation 5 days, DO meter, nitrification inhibitor added, seeded. APHA 5210 B (modified) : Online Edition.	2 g O <sub>2</sub> /m <sup>3</sup>	1-4
Nutrient Profile		0.0010 - 0.010 g/m <sup>3</sup>	1-4
Faecal Coliforms and E. coli profile			
Faecal Coliforms	Membrane Filtration, Count on CCA agar, Incubated at 44.5°C for 21-24 hours. APHA 9222 D (modified) : Online Edition.	1 cfu / 100mL	1-4
Escherichia coli	Membrane filtration, Count on CCA agar, Incubated at 44.5°C for 21-24 hours. APHA 9222 I (modified) : Online Edition.	1 cfu / 100mL	1-4

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 14-Jun-2024 and 21-Jun-2024. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Ara Heron BSc (Tech)  
Client Services Manager - Environmental

## Certificate of Analysis

Page 1 of 2

<b>Client:</b>	Pattle Delamore Partners Limited	<b>Lab No:</b>	3605134	SPV1
<b>Contact:</b>	Kimberly Murphy C/- Pattle Delamore Partners Limited PO Box 9528 Newmarket Auckland 1149	<b>Date Received:</b>	13-Jun-2024	
		<b>Date Reported:</b>	21-Jun-2024	
		<b>Quote No:</b>	130161	
		<b>Order No:</b>		
		<b>Client Reference:</b>	A028030001	
		<b>Submitted By:</b>	Kimberly Murphy	

Sample Type: Aqueous				
Sample Name:		B Bottom 12-Jun-2024 9:15 am	A Top 12-Jun-2024 9:50 am	A Top Repeat 12-Jun-2024 9:30 am
Lab Number:		3605134.1	3605134.2	3605134.3
Individual Tests				
Turbidity	NTU	6.9	0.89	1.01
pH	pH Units	7.7	7.4	7.1
Electrical Conductivity (EC)	mS/m	149.8	151.6	153.4
Total Sodium	g/m <sup>3</sup>	230	230	230
Chloride	g/m <sup>3</sup>	330	340	340
Total Nitrogen	g/m <sup>3</sup>	5.4	6.4	6.3
Total Kjeldahl Nitrogen (TKN)	g/m <sup>3</sup>	0.78	< 1.0	0.87
Total Organic Nitrogen (TON)	g/m <sup>3</sup>	0.75	< 1.1	0.83
Total Phosphorus	g/m <sup>3</sup>	0.43	0.49	0.50
Carbonaceous Biochemical Oxygen Demand (cBOD <sub>5</sub> )	g O <sub>2</sub> /m <sup>3</sup>	< 2	< 2	< 2
Faecal Coliforms and E. coli profile				
Faecal Coliforms	cfu / 100mL	170 #1	< 10 #1	< 10 #1
Escherichia coli	cfu / 100mL	160 #1	< 10 #1	< 10 #1
Nutrient Profile				
Total Ammoniacal-N	g/m <sup>3</sup>	0.030	0.035	0.038
Nitrite-N	g/m <sup>3</sup>	0.121	0.46	0.45
Nitrate-N	g/m <sup>3</sup>	4.5	5.1	5.0
Nitrate-N + Nitrite-N	g/m <sup>3</sup>	4.7	5.6	5.4
Dissolved Reactive Phosphorus	g/m <sup>3</sup>	0.30	0.33	0.32

### Analyst's Comments

Due to unexpected sample numbers and limited resources, we were unable to commence the carbonaceous Biochemical oxygen demand (cBOD<sub>5</sub>) analyses on the day that they arrived at the laboratory. The analyses were performed, as soon as possible, on the frozen samples.

#1 Statistically estimated count based on the theoretical countable range for the stated method.

### Summary of Methods

The following table(s) give a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Labs, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-3
Total Digestion	Nitric acid digestion. APHA 3030 E (modified) : Online Edition.	-	1-3
Turbidity	Analysis by Turbidity meter. APHA 2130 B (modified) : Online Edition.	0.05 NTU	1-3



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Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
pH	pH meter. APHA 4500-H <sup>+</sup> B (modified) : Online Edition. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-3
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B : Online Edition.	0.1 mS/m	1-3
Total Sodium	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B : Online Edition.	0.42 g/m <sup>3</sup>	1-3
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m <sup>3</sup>	1-3
Total Nitrogen	Calculation: TKN + Nitrate-N + Nitrite-N. Please note: The Default Detection Limit of 0.05 g/m <sup>3</sup> is only attainable when the TKN has been determined using a trace method utilising duplicate analyses. In cases where the Detection Limit for TKN is 0.10 g/m <sup>3</sup> , the Default Detection Limit for Total Nitrogen will be 0.11 g/m <sup>3</sup> . In-house calculation.	0.05 g/m <sup>3</sup>	1-3
Total Ammoniacal-N	Phenol/hypochlorite colourimetry. Flow injection analyser. (NH <sub>4</sub> -N = NH <sub>4</sub> <sup>+</sup> -N + NH <sub>3</sub> -N). APHA 4500-NH <sub>3</sub> H (modified) : Online Edition.	0.010 g/m <sup>3</sup>	1-3
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO <sub>2</sub> <sup>-</sup> I (modified) : Online Edition.	0.002 g/m <sup>3</sup>	1-3
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - Nitrite-N. In-House.	0.0010 g/m <sup>3</sup>	1-3
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO <sub>3</sub> <sup>-</sup> I (modified) : Online Edition.	0.002 g/m <sup>3</sup>	1-3
Total Kjeldahl Nitrogen (TKN)	Total Kjeldahl digestion, phenol/hypochlorite colorimetry. Discrete Analyser. APHA 4500-N <sub>org</sub> D (modified) 4500 NH <sub>3</sub> F (modified) : Online Edition.	0.10 g/m <sup>3</sup>	1-3
Total Organic Nitrogen (TON)	Calculation: TKN - NH <sub>4</sub> -N. In-house calculation.	0.10 g/m <sup>3</sup>	1-3
Dissolved Reactive Phosphorus	Filtered sample. Molybdenum blue colourimetry. Flow injection analyser. APHA 4500-P G (modified) : Online Edition.	0.004 g/m <sup>3</sup>	1-3
Total Phosphorus	Total phosphorus digestion, automated ascorbic acid colorimetry. Flow Injection Analyser. APHA 4500-P H (modified) : Online Edition.	0.002 g/m <sup>3</sup>	1-3
Carbonaceous Biochemical Oxygen Demand (cBOD <sub>5</sub> )	Incubation 5 days, DO meter, nitrification inhibitor added, seeded. APHA 5210 B (modified) : Online Edition.	2 g O <sub>2</sub> /m <sup>3</sup>	1-3
Nutrient Profile		0.0010 - 0.010 g/m <sup>3</sup>	1-3
Faecal Coliforms and E. coli profile			
Faecal Coliforms	Membrane Filtration, Count on CCA agar, Incubated at 44.5°C for 21-24 hours. APHA 9222 D (modified) : Online Edition.	1 cfu / 100mL	1-3
Escherichia coli	Membrane filtration, Count on CCA agar, Incubated at 44.5°C for 21-24 hours. APHA 9222 I (modified) : Online Edition.	1 cfu / 100mL	1-3

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 14-Jun-2024 and 21-Jun-2024. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.

Ara Heron BSc (Tech)  
Client Services Manager - Environmental