Exemplar for Internal Achievement Standard

Geography Level 1

This exemplar supports assessment against:

Achievement Standard 91933

Explore an environment using data

An annotated exemplar is a sample of student evidence, with a commentary, to explain key aspects of the standard. It assists teachers to make assessment judgements at the grade.

New Zealand Qualifications Authority

To support internal assessment

Grade: Achieved
For Achieved, the student needs to explore an environment using data. The student has processed data and generated visuals. The presented data includes bar graphs, annotated photographs, and annotated maps. The lake environment has been defined with the use of annotated maps. The presented data has been used to describe findings about the environment. As noted in Explanatory Note 4, findings are the student's understanding about an environment that is found and drawn from the processed data. For example, findings from the water clarity bar graph show that the water clarity is not good and could be dangerous for humans and wildlife. The student has had sufficient data to present and enable them to describe findings from this evidence to explore an environment. How the data from one day limits understanding of the lake environment has been described. For Merit, the student would use the presented data to explain findings about the environment. A Merit response would also explain how data can strengthen and limit understanding of the environment.

Achieved

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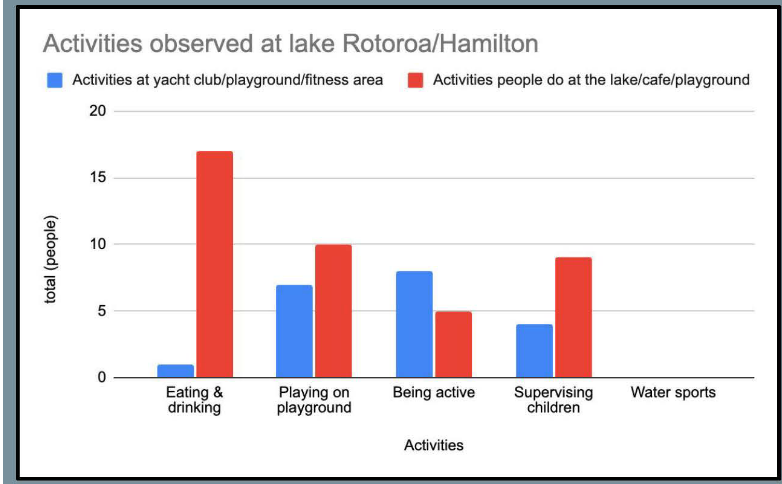
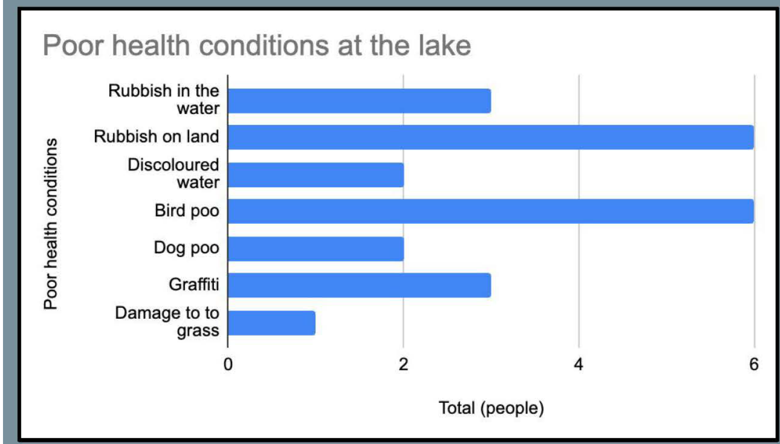
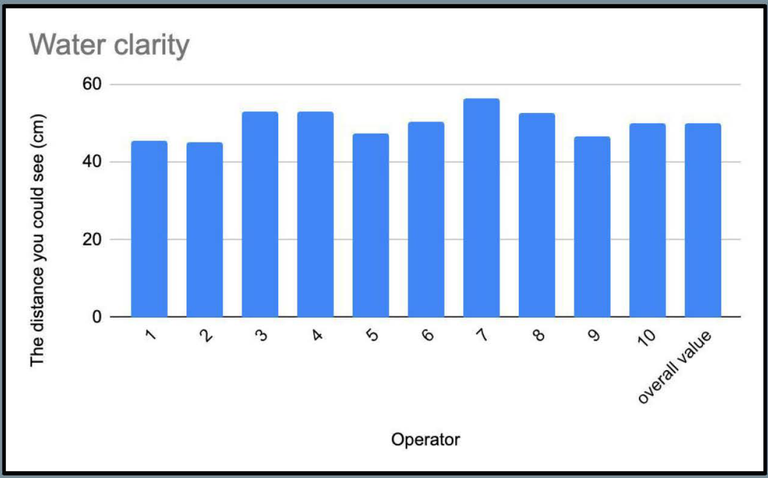


This graph is showing me the activities that people at the lake are doing. Not only around the yacht club, but also at the cafe area and the playground there. It shows me how many people like to visit the lake and participate in different activities showing the usage of the lake. This links back to the water conditions because, at the cafe verandah area there's quite a lot of people eating and drinking which could explain the rubbish found around the lake.



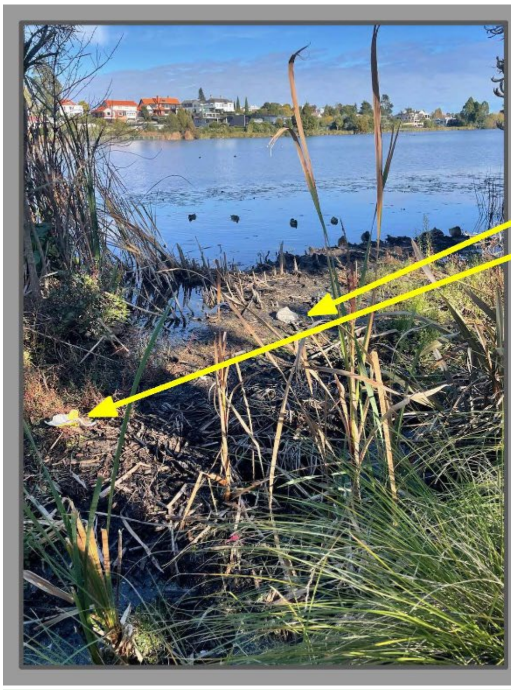
This graph shows me the poor health conditions at the lake. There is quite a lot of rubbish on land and bird poo. These both could be causing the water to have poor quality. This graph gives me a clearer indication of what the different things could be making the water quality the way it is.



The water clarity bar graph shows me that you can see over a average, 50 centimetres through the lakes water. The water clarity is not good because you need to be able to see what is underneath you in the water, and without knowing that, it could be really dangerous. This links back to the water quality because its not only dangerous for humans but also for the wild life living in the lake.

This here is a drainage pipe. This is definitely a main cause on to why the water clarity isn't good, and also a clear problem to the poor health conditions at the lake. For example this is most definitely a cause of the smell, the rubbish and murky water in and at the lake.

This is also murky and discoloured water. This is another clear indication on why the lakes water quality is very poor.



Here are two examples of the lakes poor health conditions. The arrows are pointing at the two pieces of rubbish on lake premises. This is definitely a problem, it affects the waters health because rubbish in water is an indication of pollution. This is not good for the wildlife in and around the lake. The creatures could intake this litter and end up trapped, or dead. Animal feces are not good to have in the water, it would make the e-coli and bacteria in the water rise making it worse for the water life.

MAP SHOWING

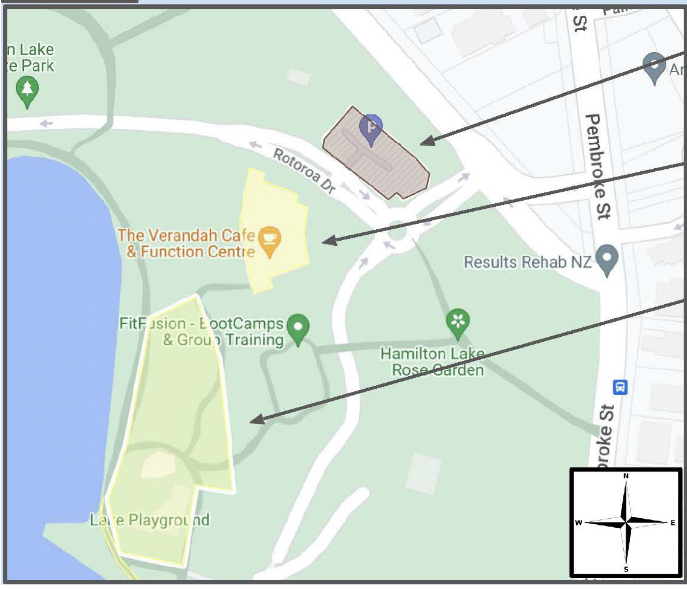
1) RECREATIONAL (public space, parks, walking track, etc.)
2) RESIDENTIAL (houses/apartments.)
3) CARPARK
4) OTHER

1)
2)
3)
4)

The map is a clear look on what the land use is around the lake and how it could affect the water quality.

Recreational (public space, parks, walking track, etc.)

Carpark



This, as from the colour key is a carpark.

This is the cafe, which is recreational.

This is the verandah playground/lake playground, which is also recreational.

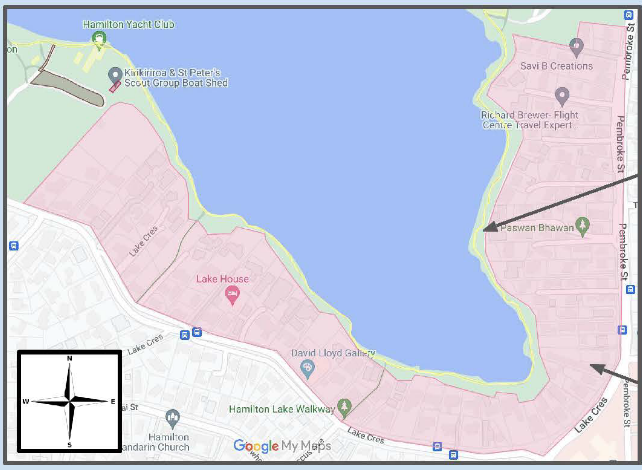
The cafe is somewhere where people can eat and drink, it brings more people too the lake making it easier for bins to be filled. Causing overflowing bins and litter being left around. Also the kids playing on the playground

Recreational (public space, parks, walking track, etc.)

Other

Residential (houses/apartments.)

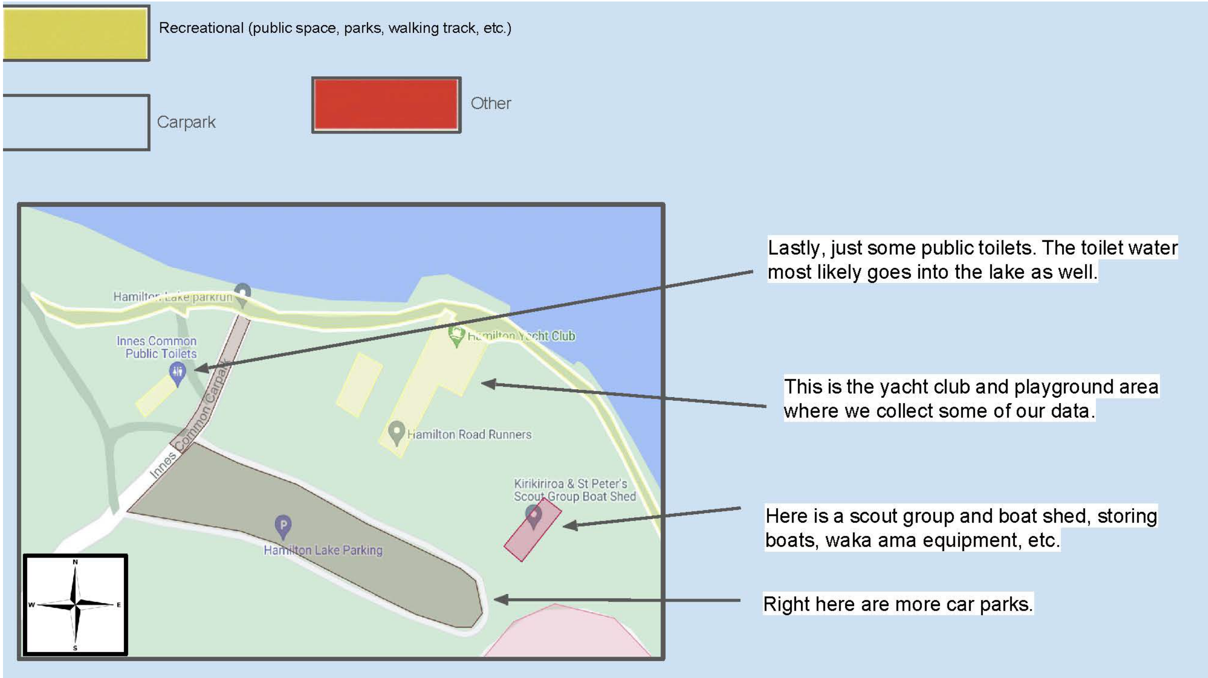
Carpark



The long yellow line is a walking track that goes right around the lake for the community to walk around.

This map shows me that there is a lot of residential area around the lake. This affects the water quality. For example storm water drains are are more likely to be around the residential area because of flooding. There made for rain water but little, sometimes big pieces of rubbish can get in the drains. They drain all of that water into the lake making the lake full of tiny, and big pieces of rubbish and other bacterias, etc.

Highlighted pink are all the houses and apartments along the lakefront.



Limitations

Firstly we took data from only one day around the times where people would be at school or work. For example if we went back on a Saturday or Sunday it would be different. Maybe not the lakes water, but there would be more people around walking, playing on the playground, doing activities, and at the cafe. This limits my understanding of the lakes health of the environment and the lake because, the environment and lake could be a lot different on a weekend day. For example the people effect the rubbish in bins and on the floor. But also the lakes water can change if it were to be the winter and there had been a storm the lakes water would be different, and there would probably be more rubbish around the area.

strengths

we collected data to make graphs which made it easier to understand the concept of what we were trying to find out, (the health of the lake) and what the reasons could be. We also interviewed people at the lake which helped us understand why people come to the lake. The annotated photos helps to see what it actually looks like at the lake.

conclusion

- In conclusion Seems like there are quite a few problems impacting the well-being of Hamilton Lake and its environment. The water clarity issues shown in my graph (could only see 50cm through the water). Presence of rubbish as can be shown in my photos that there is rubbish in and around the lake, stormwater pipes flowing into the lake as you can also see in my photos that the pipes are leading into the lake from the stormwater drains, and the abundance of litter and animal waste all play a role in the lake's poor condition as shown in my graph that there was a large amount of rubbish on land and bird poo. Additionally, the graffiti and untidiness in the area don't help. It'll take a lot of effort to clean up the surroundings and restore the lake to a healthier state.

Grade: Merit
For Merit, the student needs to interpret an environment using data. The student has processed raw data and presented visuals in the form of graphs and annotated photographs. The school environment has been defined with the use of an annotated map. The presented data has been used to explain findings about the environment. For example, the presented temperature bar graph is explained using the annotated photographs. The highest temperature in the graph, at site 3, is explained using the photographs and annotations to show that this site is protected from the wind. The range of climate data used has enabled microclimates within the environment to be identified and explained. The evaluative aspect explains how the data can strengthen and limit understanding of the school campus environment. The understanding of the environment has been limited, as the data hasn't enabled "seasonal or long-term weather patterns" to be considered. More explicit linking of specific data and understanding of the environment would further strengthen the evidence to reflect Merit. At 1639 words, this response exceeds the expected length for this standard. The response could be reduced through a more critical selection of evidence. For Excellence, the student would use the findings to draw a valid conclusion about the school's microclimate environment. While some of these aspects have been identified in the student response, further use of findings and a cohesive conclusion is required. For Excellence, there would be discussion of how additional data could be used to improve understanding of the school environment. Long term monitoring of weather was identified, however an Excellence response would further discuss how this additional data would improve understanding of the school environment.

Merit
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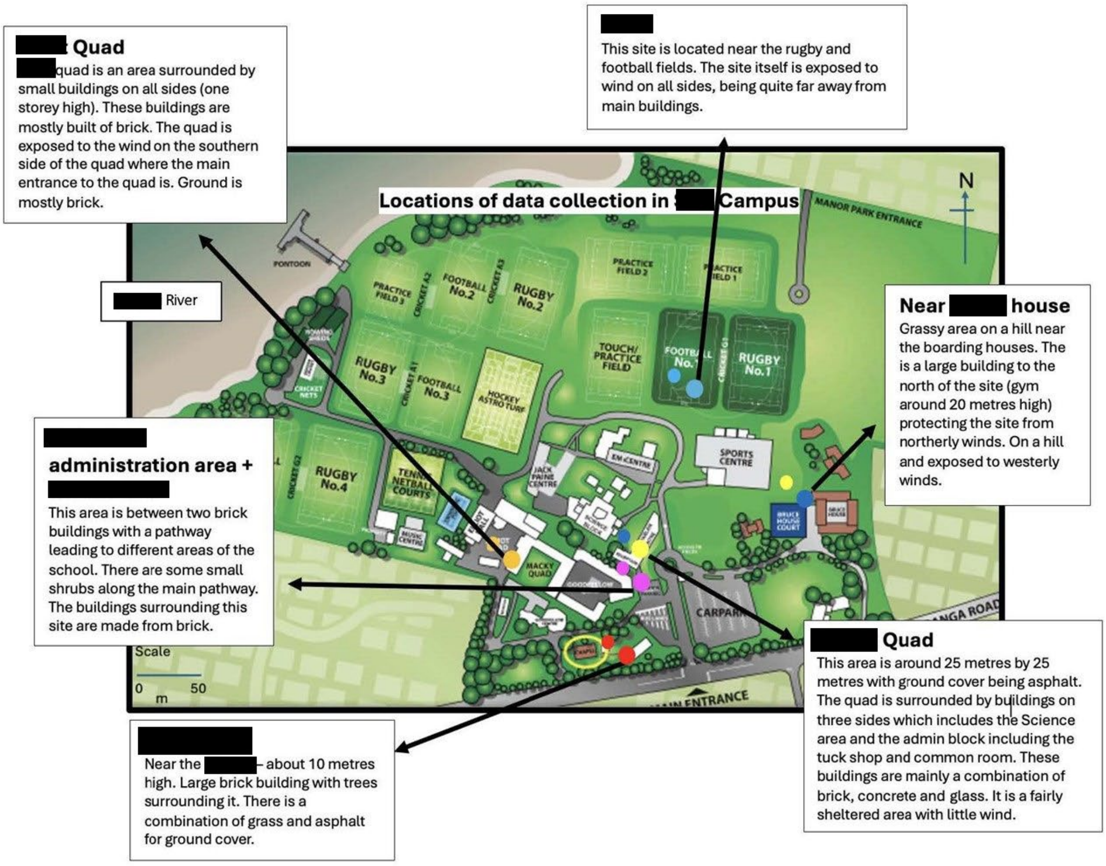


Data 1 – Annotated Map

- Site 1 - [redacted]
- Site 2 – [redacted]
- Site 3 – [redacted]
- Site 4 – [redacted]
- Site 5 – [redacted]
- Site 6 – [redacted]

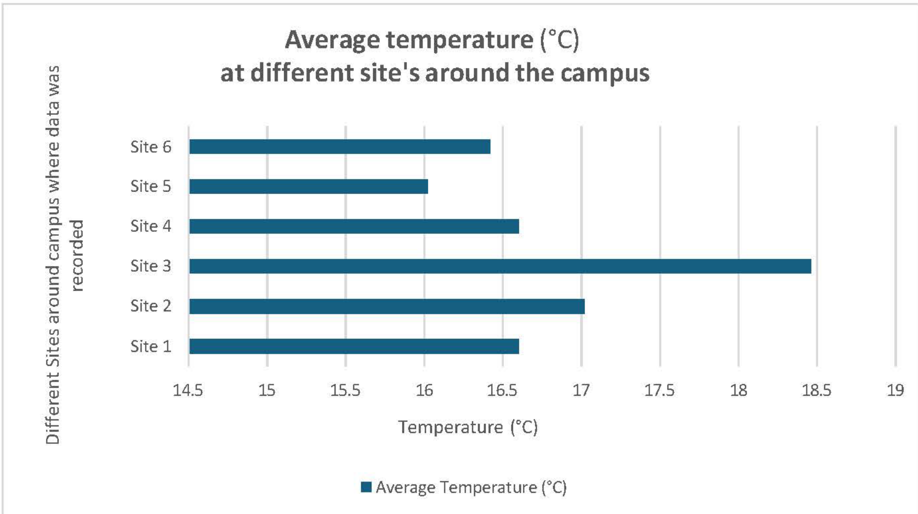
The above map displays the different areas in the campus where data was collected for this assessment. As you can see, the campus includes roads, buildings and fields, with a close proximity to the Tamaki River. The fields are located north of the campus, while most buildings are south.

To measure the data, we used two different types of field equipment. The first was a UT363 BT Mini Anemometer and thermometer, which was used to measure wind speed and temperature. The second device, UT333BT Temperature and Humidity Meter, measures humidity and temperature.
At the different locations, we used these instruments to record the data.

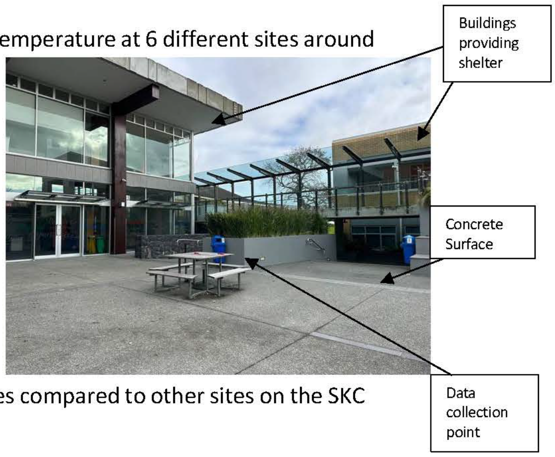
Summary Table of Data collected:

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
Temperature °C (average)	16.6	17.62	18.54	16.6	16.02	16.42
Temperature °C (range at location)	15°- 18.5°c	17 - 18°c	18.1-18.	15.5- 18.4°c	14.6- 17.8	15.3-18.2
Cloud cover (oktas, or eighths of the sky) (average)	5.2	4.4	5.7	5.2	4.8	0
Wind speed (m/sec) (average)	1.81m/sec	1.08m/sec	0.9m/s	3.36	2.24	1.24
Wind speed (m/sec) (range)	4.1	2.4	0-1.7m/s	0.0-8.8	0.0-6.5°c	0-2.2°c
Wind direction (Most common – mode)	East	north	NA	N	S	W
Humidity % (average)	76.62%	74.52%	71.4	77.36	75.06	75.06
Personal comfort index (layers) (average)	2	2	2	2	2	2

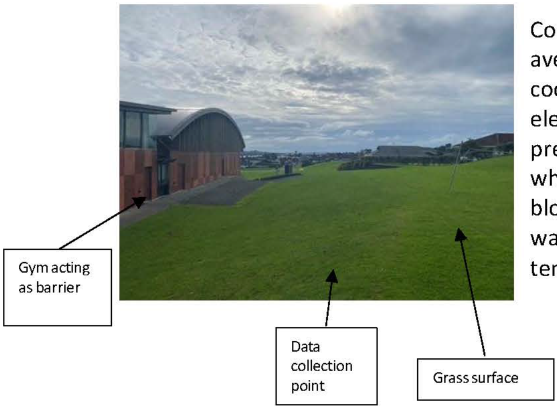
Data 2 – Temperature



The graph above displays the variation of average temperature at 6 different sites around the campus.



For temperature, site 3 (quad) has the highest average of 18.46°C. This is notably warmer compared to the other sites. This higher temperature could be influenced by geographical features like the fact that it has more protection from wind. This is because the quad is surrounded by buildings on three sides which includes the Science area and the admin block including the tuck shop and common room. These structures reduce wind exposure, thereby contributing to slightly higher average temperatures compared to other sites on the SKC campus.

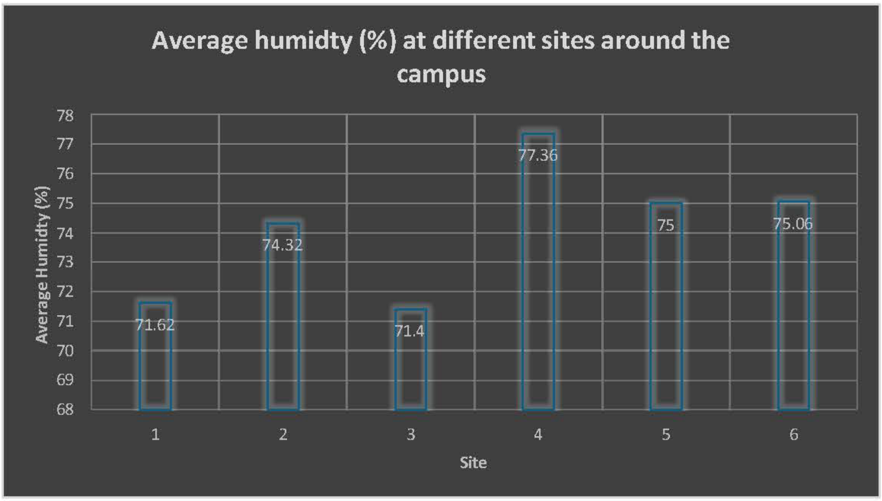


Conversely, site 5 (near house), has the lowest average temperature at 16.02°C, demonstrating a cooler environment. Site 5 experiences higher elevation and is exposed to southerly winds. The presence of a large building to the west (the gym, which is around 20 meters high) acts as a barrier, blocking westerly winds that could possibly bring warmer air. This therefore maintains cooler temperatures at the house site. Instead, cool southerly winds from areas like Antarctica could be influencing the overall temperature of the site.

The surfaces of the ground also contribute to the temperature at different sites. With the quad being primarily made up of dense concrete and rock, it absorbs the solar radiation from the sun during the day. This contributes to an increased surface temperature of the concrete, which can lift the overall air temperature above it. This explains why areas with concrete ground surfaces like the quad can contribute to higher temperatures.
On the other hand, grass has a high degree of reflectivity (albedo), meaning that it reflects more solar radiation away from it's surface, resulting in less absorption of heat compared to concrete. As a result of this, air temperatures around grass surfaces like the field remain cooler.

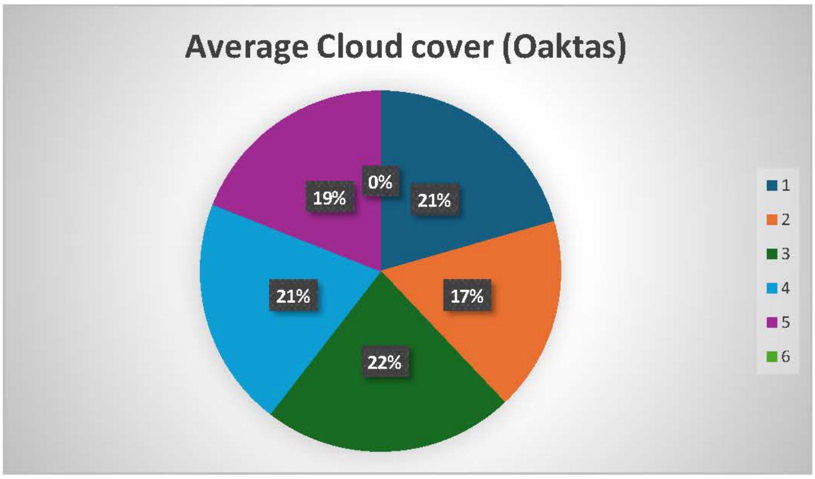
Sites 1,4, and 6 display intermediate temperatures from 16.6°C to 16.42°C with a range of 0.18°C. This proposes more uniform conditions.

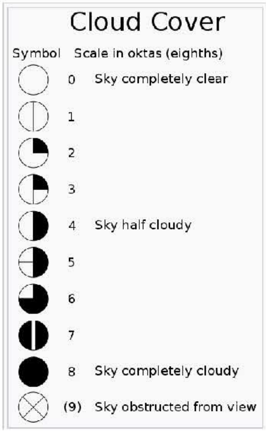
<u>Data 3 – Humidity</u>



The graph above shows the average humidity (%) at the different sites around the campus.
Site 4 (Field) records the highest average humidity at 77.36%. A factor that could contribute to this is its close proximity to the Tamaki River. Large bodies of water like the Tamaki river are constantly evaporating moisture into the air surrounding. This in turn impacts the overall humidity in the area as there is an increase of moisture in the air.
The fairly cold average temperature of site 4 (16.6°C), also contributes to increased humidity. This is because colder temperatures usually lead to the condensation of water vapour in the air, increasing humidity levels.
Site 3 (Quad) records the lowest average humidity at 71.4%. This is a significant difference of 5.96 between the highest and lowest humidity.
There are many reasons as to why this particular site does have the lowest average humidity, one of which being a lot further from all other sites from a body of water such as the Tamaki river. This means that there is not as many sources which contribute to moisture to the air, therefore resulting in lower humidity.
Other potential reasons can be due to site 3's topography. Topography in simple terms describes the sites situation, elevation and land pattern. Areas with less vegetation such as quad contributes to its lower humidity due to faster drying of the air.
Also, site 3 is known to be a region in which encounters a lot of winds. These winds bring in dry air from inland or regions of lower humidity.
While a specific temperature for site 3 is not known, colder temperatures can also play a vital role in the lower humidity due to a reduced capacity of the air to hold moisture.

Data 4 – Cloud Cover





This average cloud cover (oktas) shows the variability of sky conditions across 6 different sites across the campus. It has been put in the form of a pie graph.

As can be seen, site 3 (quad) is shown to have the highest average cloud cover at 5.7 oktas. This higher cloud cover suggests that site 3 sees more frequent and thicker clouds compared to other sites investigated here. This could be due to how sheltered the area is. The quad being surrounded with buildings can create microclimate conditions, favourable for cloud formation. Orographic lifting can also occur due to the quad having low-elevation. This is when the moist air is forced to go over/rise over higher surrounding buildings, adiabatically cooling and condensing, creating clouds.

On the other hand, site 6 (Between XXXXX and Admin area) shows 0 average oktas, indicating no visible cloud cover. This could be due to several factors such as its again, geographical position in rain shadow or if it's under the influence of dry air masses from nearby high pressure system. Site 6 experiences slightly more stable atmospheric conditions like temperature and humidity, resulting in clearer skies and minimal cloud formation.

Sites with moderate cloud cover, which are sites 1,4 and 5, range from 4.4 to 5.2 oktas, suggest a balanced mix of cloudiness varies depending on seasonal and daily weather patterns.

Conclusion

The initial aim of this research was to find out whether there is spatial distribution across the college campus. Over the 5 days of data collection, it is evident that weather indicators like the ones I investigated including temperature, humidity and cloud cover, all exhibit variations across different areas of the school environment, therefore reflecting varying degrees of spatial distribution .

The annotated map provided shows us the buildings and land formations that contributes to weather indicators at each site.

The temperature shows significant differences, with site 3 (quad) recording the highest average temperature due to its very sheltered position and concrete surface that absorbs more solar radiation. The site with the lowest recorded temperature was site 5 (near house). This is likely influenced by its higher elevation and exposure to southerly winds.

Humidity levels show much variation as well, with site 4 (field) displaying the highest average humidity of 77.36%. This is attributed to its close proximity to the Tamaki river and colder temperatures. Site 3 (Quad), shows the lowest average humidity of 71.4%, due to its distance from water sources and exposure to dry winds.

Site 3 indicates the highest average cloud cover of 5.7 oktas. Showing a frequent clod formation in it's sheltered microclimate.

In conclusion, this research illustrates how local geographical features , such as temperature , humidity, and cloud cover have a profound effect on spatial distribution across the campus and we can directly see, through analysis of data collected the differences in the campus environment.

We can also see how structures create microclimatic variations that influence weather indicators across the campus.

Strengths

The findings of my data that I have presented has strengthened my understanding of spatial variation of weather across the school campus. By measuring different weather indicators like temperature, humidity and cloud cover at different locations, the differences between microclimates become clear. For example, areas like Quad that are sheltered by buildings display higher temperatures. For me, this highlights the impact of built environments on local climate. Similarly, different humidity levels at inland sites versus sites closer to the water sources influence humidity levels. This analysis enhances my insight into how microclimatic factors influence weather patterns withing a confined geographical area like our school campus.

Limitations

The data I have presented also has limited scope for understanding spatial variation of weather across the school. One limitation is that the data collection duration was relatively short (5 days). This doesn't capture seasonal variations or long term weather patterns. Also, the amount of different measurement points (6) doesn't fully represent the diversity of microclimates across the entire school campus. Limitations like this suggest that while the data offers a small snapshot, a more comprehensive and extended study would provide a better understand of spatial weather variation at the campus.

Additional Data

Additional data could be used to improve my understanding of the spatial variation in weather across the school. This could include long-term monitoring and extending the data collection over more seasons would capture seasonal trends and variability, providing more insight .
Secondly, ensuring that the measurements were taken at the same time of day would help provide more precise data, improving variables within the data.
Altogether, this would provide a strong understanding of the school enviroment.

Grade: Excellence
For Excellence, the student needs to analyse an environment using data. Data has been processed by the student and the visuals presented. This presented data includes graphs, annotated photographs, and annotated maps. The Wairau Creek environment has been defined with the use of annotated maps. The presented data has been used to explain findings about the environment. For example, high phosphate levels shown in the bar graph are explained using the photograph and map presentations. The student has explained how data such as interviewing locals strengthened understanding of the environment by giving long term information on the conditions of the marina and beach. There is also an explanation of how nitrate readings limit understanding of the environment, as it doesn’t give information about the type or areas of pollution. How additional data, such as collecting data over a longer time period and better testing kits, could be used to improve understanding of the environment is discussed. Findings have been used to draw a valid conclusion about the environment. Overall, the Wairau Creek has been concluded as polluted.

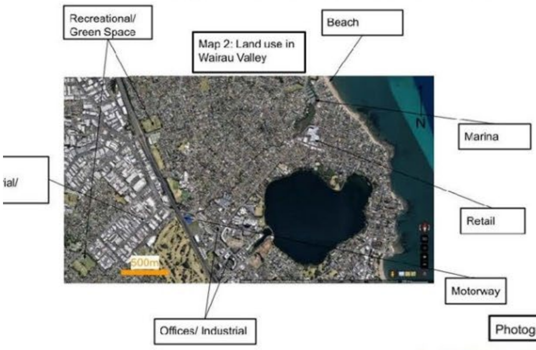
How polluted is Wairau Creek?

The Wairau Creek system runs through Wairau Valley, which is a mix of industrial and residential areas. Wairau Creek is known for its highly polluted rivers, and we wanted to confirm that. Stuff reporter Brad Flahive in 2019 said, "It's north Auckland's biggest industrial area, but Wairau Valley is causing a pollution crisis at local beaches and streams."

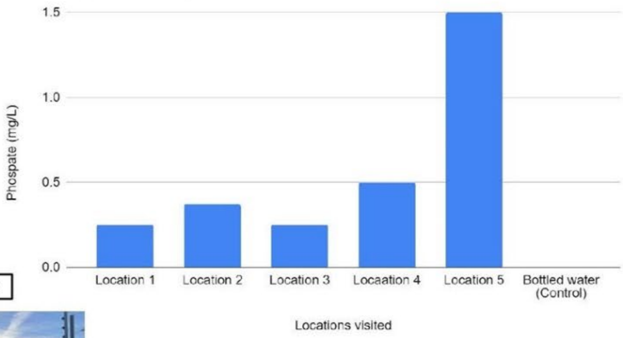
Map 1: A map to show visited locations

According to the results presented in Graph 2, it is very clear to see that Wairau Creek is polluted. At all locations, there is some amount of phosphate in the water; location 5 is the most polluted with 1.5 mg/L. Location 5 is the last before the creek flows into salt water and the different streams meet together, which is why the phosphate is so high because the runoff from the industrial area shown in Map 2 builds up to location 5, meaning each location contributes to the phosphate levels. At the end of 2018, Auckland Council believed ¼ of the industrial sites in Wairau Valley had the potential to pollute the waterways. As we can see in photograph 2, a boat business is washing a boat with chemicals, and the runoff is flowing into the drains at location 3, which is in the industrial area, and the water from here flows to location 5. Mr. [redacted], a business owner at Location 3, said they do try to capture their runoff using sediment traps, but this does not stop other pollution from entering the creek.

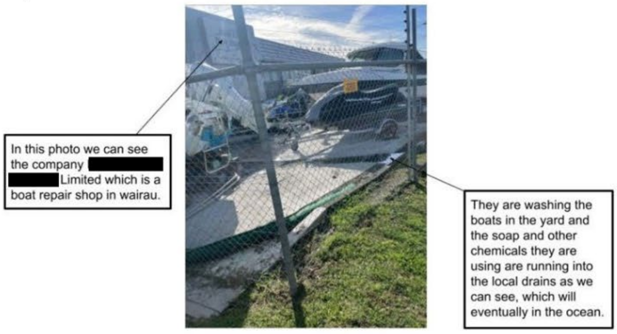
Map 2: Land use in Wairau Valley



Bar Graph 2: Phospate at each location



Photograph 2



We can also see from our findings in Graph 1, the water clarity, that the creek is polluted. Compared to our control, the water is dirty at every location, with a clarity below 70 cm. The clarity at location 2 is the worst, at 27 cm; this is most likely because of the industrial area and the runoff shown in photo 2, with soap and chemicals making the water cloudy and discoloured. This is why the water clarity was impacted so heavily at location 2 in graph 1. We can also see in photo 1 the colour of the water at location 3 and the oil leakage in photo 3, These are both outcomes of their environment. An article in 2023 said blockages could often be caused by 'fatbergs' - a combination of fats, oils, and grease mixed with things like wipes and rags, which could also affect the clarity of the water.

Bar Graph 1: Clarity at each location

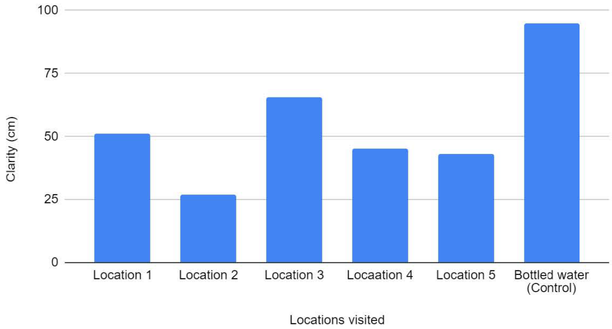


Photo 1

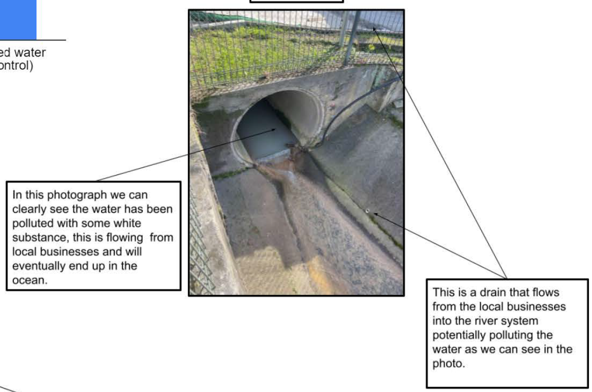
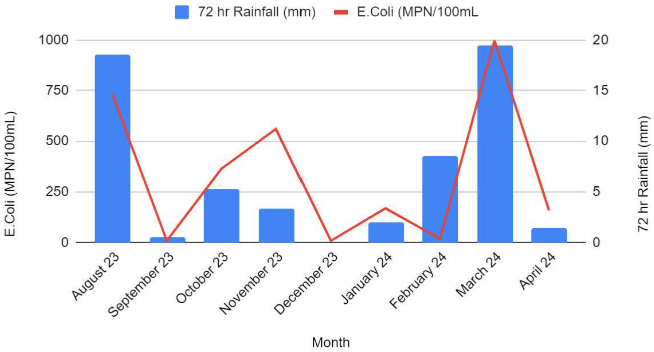


Photo 3

It is evident from the statistics in Graph 3 that E. coli pollution of Wairau Creek/Milford Marina Estuary is an additional problem. E. coli is a year-round indicator of wastewater and stormwater overflow pollution in the water. With 997 MPN/100 mL, March 2024 was the most polluted month, followed by August 2023 (730 MPN/100 mL). This is because, as Graph 3 illustrates, August and March have the most rainfall, which influences the levels of E. coli because of overflowing stormwater drains and significant runoff from urban residential property. With higher amounts of rainfall, the amount of E. coli in the waterways increases, which could mean there is a problem with the sewage and storm drains if they overflow so easily. Even with no rainfall in December, this tells us that there is E. coli in the water year round no matter the rainfall.

Bar Graphm 3: Wairau creek outlet rainfall and E.Coli graph



The answer to the question ‘Is Wairau Creek polluted?’ is yes. From the data collected in Graph 2, the phosphate at location 5 is where all the build-up from the other locations comes from, causing the phosphate to skyrocket. The pollution comes from industrial areas, residential areas, and greenspace, as shown in map 2, giving us an idea of the pollution levels in the creek. The clarity of the creek overall was shocking, with the lowest being 27 cm compared to our control, which was 95 cm. This was caused by industrial runoff with a mix of chemicals and other contaminants flowing from local businesses. From the E. coli data collected, the higher the amount of rainfall there is, the more E. coli in the water, with the highest amount coming in March at 997 MPN/100 mL. But there is always E. coli in the water. As we could see in December with no rainfall, there is still E. coli in the waterways. Based on all the data we collected, it is clear that Wairau Creek is polluted.

Interviewing locals strengthened my understanding because it gave us information on the condition of the marina and beach. This is important because the creek ends at the beach. Some residents have been living there for 30 years and have seen the creek go from clean to dirty. This broadened our view of how long the creek has been dirty. But also, a few residents had been living there for short periods, and they were saying they had never seen the marina clean. The nitrate readings were not sensitive, which limits my understanding because it does not tell us about that type of pollution; we won't be able to know what areas are higher or lower polluted, so it minimizes our data bracket to 3 types of pollution. We visited several locations, which strengthened my understanding because we were able to see the different levels of pollution in different areas and see what effects the environment had on the water. This gave us a wide spread of results in our data. We only visited on one day of the year, which limits my understanding because it doesn’t let us see if the data was going to be different if the weather changed, or if something else happened that could affect the amount of pollution.

Additionally, there were a few things that could have improved our data. The first is time, If we went down to the 5 sites and tested every day at the same time for a whole year, this would have greatly improved our data because we would have been able to get more accurate data because of the longer time period. If we could buy better testing kits and other kits that were able to find other types of bacteria and pollution, it would have given us a greater understanding of the types of pollution that are in the river and more accurate accounts of where the pollution was coming from.