Identifying the Beckenham Community's Aspirations for the Ōpāwaho-Heathcote Riparian Land

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18 October, 2024

Helms, H., Newport, E., & Rhind, S. (2024). Identifying the Beckenham Community's Aspirations for the Ōpāwaho-Heathcote Riparian Land. *A Report for James Beck as part of the GEOG309 Research for Resilient Environments and Communities course, University of Canterbury, 2024*

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Executive Summary

- **Objective**: Identify the Beckenham community's connection and aspirations for the Ōpāwaho Heathcote riparian land.

- **Methodology**:
    - Mixed-methods approach.
    - Qualitative data collected through semi-structured interviews with community group leaders.
    - Quantitative data gathered from a survey distributed to the wider Beckenham community.
    - Conducted various water quality tests to assess the river's health.

- **Key Findings**:
    - Strong community support for native riparian bush regeneration.
    - Interest in implementing ecological education in local schools.
    - Desire for infrastructure developments.
    - These themes reflect the community's aspirations for enhanced care and comfort at the Ōpāwaho-Heathcote River.
    - The area is frequently visited by respondents, underscoring its importance for community well-being and connection.

- **Limitations**:
    - Limited timeframe restricted the analysis of additional research that could have benefited the project.

- **Future Research Recommendations**:
    - Create a visual plan of the riparian land that incorporates community aspirations.
    - Conduct further water quality tests that account for external factors.
    - Analyze soil composition and structure to support successful vegetation growth.

Introduction

The University of Canterbury was approached by James Beck, the pastor of The River Ōpāwaho Church, to identify the aspirations of the Beckenham community regarding the approximately one-kilometre stretch of Ōpāwaho Heathcote riverside land (see Figure 1). This report aims to explore the community's connection to the river and their aspirations through a series of qualitative and quantitative surveys. Additionally, a basic water quality test was conducted to assess the current health of the river. This research aimed at answering the following questions:

- What connection does the Beckenham community have with the river?
- Do values and connections to the river differ among key community leaders?
- What is the Māori heritage of the area?
- What riparian land use would benefit the community?
- What do water quality parameters indicate?

The data collected revealed the Beckenham community's strong sense of connection to the river and their commitment to improving its health.

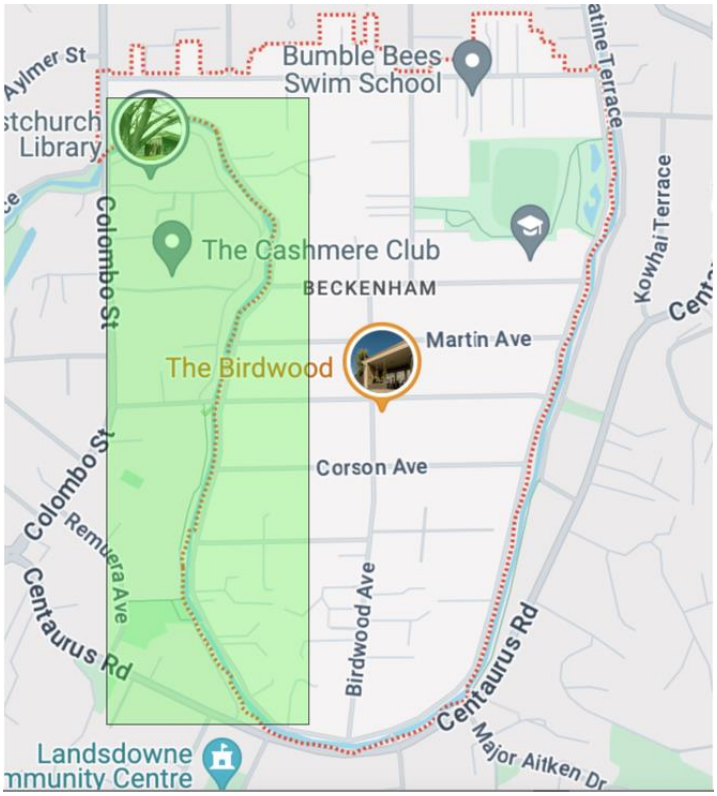

Figure 1. Focus Location

Literature Review

A variety of literature was reviewed to access foundational knowledge that aligned with the research questions above. These included the Māori connection with water, the impacts of native versus exotic plants in riparian areas and the biophysical aspects of a river. This approach provided insights into the cultural, ecological and environmental factors influencing the Ōpāwaho Heathcote River.

Historically, the Ōpāwaho Heathcote River served as a key trade route, a gathering place and a vital food source for species such as Inanga, Koura, and Kakahi. It also served significant roles in cultural practices and community identity (Morgan, 2007). Water holds deep spiritual, environmental, and cultural importance in Māori culture due to its association with "mauri," a concept that represents the life force inherent in all living things. For Māori, preserving the health of water is essential to maintain this mauri, as many traditional practices and ceremonies rely on the water's purity (Dodson, 2007). Overall, Māori culture has a strong commitment to providing environmental sustainability and maintaining cultural heritage (Boyd, 2010).

Following European colonization, the Ōpāwaho Heathcote River faced severe degradation due to urban development, pollution, and runoff, resulting in biodiversity loss and ecological decline (Dodson, 2007). However, in the 20th century, legislative frameworks such as the Treaty of Waitangi Act and the Resource Management Act increased Māori involvement, this integration of scientific and indigenous knowledge is vital for effective management of water bodies (Morgan, 2007).

In more recent years, Beckenham community planting initiatives have helped restore native vegetation in the Ōpāwaho Heathcote riparian area. Ecologically, native plants are critical to

maintaining NZ's biodiversity and environmental resilience. Native plants have evolved to thrive in local conditions, offering resources like food and shelter to native wildlife. In contrast, exotic species, often provide limited ecological benefits and do not support the native ecosystems. Native plantings contribute to soil and water quality, restore habitats, and improve the area's resilience to climate change impacts.

The Ōtautahi Christchurch Ecosystems map (based on the work of Meurk et al. (1993) provides substantial guidance for selecting native species suited to the specific conditions of the Ōpāwaho riverbank. The map identifies the 1km stretch of river as 'Kahikatea – Wet Plains' and outlines the plant list selected from vegetation natural to wet Taitapu soils. This includes noble trees (>12m) like cabbage trees which provide foods, small trees/tall shrubs (>5m) like karamu and kanuka which also provide food, and are fast-growing early successional species; groundcover herbs like harakeke (tolerant of most conditions). The Christchurch City & Lowland Canterbury Streamside Planting Guide (2013) gives information on which plants are preferred by the council in riparian zones. The stream profile zone of the area this report primarily focuses on is the lower and upper banks. The list of plants identified in this guide that are preferred in these zones is extensive, but some ideal species could include sedges like pukio and makura, or harakeke etc. as these species all tolerate wet conditions. Some shrubs and trees that could be ideal would include mikiki, weeping marou, and tī kōuka. Design considerations for the plantings should include massed vegetation to allow for waterway access and visibility while giving a safe habitat area for the local ecosystem.

Methodology

To ensure responses to the research questions were useful and accurate, a mixed methods approach was used for the project.

Qualitative Interviews

Three semi-structured interviews were conducted with four leaders from key community groups in Beckenham. The semi-structured format guided the interviews towards answering the research questions, while also allowing the interviewees flexibility to share further information. These interviews were transcribed using Otter.ai and then coded using NVivo to identify key themes relevant to the project. Each interview provided various insights relating to the river which were used to create questions in the quantitative survey.

Quantitative Survey

Building on themes and topics raised during the qualitative interviews, a quantitative survey was created on the web-based software Qualtrics. The survey was then distributed online, assisted by the interview participants who shared it amongst their networks. After two weeks, the survey data was collected. It was then analysed using the Stats iQ function on Qualtrics which allows for the comparison of variables, resulting in the development of a comprehensive analysis.

Water Quality Measurements

To gain an understanding of the water quality within our focus location of the Ōpāwaho Heathcote River basic water quality tests were conducted two sites. The parameters measured were pH, temperature, turbidity, nitrate, phosphorous, clarity, dissolved oxygen, conductivity, and did a raw data macroinvertebrate count.

Biophysical

River function

The physical structure of rivers begins with the headwaters that provide the initial mass of water (National Geographic, 2023). For the Ōpāwaho-Heathcote River, this water comes from springs. These are locations where water from subsurface flows emerges to the surface and flows above the ground (Glazier, 2009). Springs are each unique due to their biology, hydrology, chemistry, and temperature amongst others that ultimately determine their biophysical dynamics. However, springs similarly all form from precipitation of snow or rainwater. This water is collected underground between impermeable rock and aquifers (rock that allows water to flow through). This flows via pressure and gravity as subsurface flows and travels in directions that have lower friction or drag. This water becomes a spring when the top layer of this subsurface water emerges above the ground via cracks, permeable rock or other pathways (Glazier, 2009).

River flow

The flow of a river is in one direction and is caused by both the force of gravity on the water mass, and the elevation gradient of the land (topography). These factors determine the river's energy which affects the speed of the river flow (Bukaveckas, 2009). The steeper the gradient from the headwaters to the river's end the faster the river will flow due to gravity having a greater effect. The speed of rivers is also affected by the depth and width of the channel. As both increases, it corresponds to a greater mass of water flowing, increasing its energy (Ames, 2018).

As rivers flow, additional water is accumulated via precipitation processes (such as runoff) and tributaries, whilst some are removed through evaporation (National Geographic, 2023). The largest natural tributary contributing to the Ōpāwaho-Heathcote River is the Cashmere

Stream. Other, smaller, tributaries include Steamwharf Stream, Haytons Stream, Coulings Stream, Curletts Road Stream, and creeks flowing off the Port-Hills (Ōpāwaho Heathcote River Network, n.d.). Rivers end by entering the mouth (National Geographic, 2023), which is a sea, lake, or for this river, the Avon-Heathcote Estuary (Ōpāwaho Heathcote River Network, n.d.).

Water quality

Effects of parameters

Rivers are dynamic, complex and their water quality is affected by interdependent factors (Corenblit et al., 2024), such as biological activity, river flow, sediment transportation, and stormwater amongst many others. In 2022 the Ōpāwaho-Heathcote River was rated poor using the water quality index produced by Christchurch City Council, containing high concentrations of copper, zinc, nitrate, dissolved inorganic nitrogen and dissolved reactive phosphorous (Christchurch City Council, 2023).

Copper and zinc are heavy metals that are toxic to aquatic life at high concentrations (NIWA, 2021), and that have an infinite half-life, accumulating in the environment (Greater Wellington, 2018).

Inorganic nitrogen dissolves when it enters the water and has two major effects when in excess. Firstly, it increases the amount of hydrogen ions in the water, increasing the acidity. With this, the pH of the water body decreases, negatively affecting aquatic organisms (Camargo & Alonso, 2006). Secondly, it causes eutrophication of waterways as it stimulates

plant growth (Prakash & Khanam, 2021). Nitrate also causes eutrophication at excessive concentrations (European Commission, n.d.).

When soil particles enter waterbodies, phosphorous that is bound to the soil is released, becoming dissolved reactive phosphorous (LAWA, 2023). In this form, plants can readily use it and plant growth in waterbodies increases, again if in excess causing eutrophication. Excess sediment also causes the clarity of rivers to decrease. This is harmful as the more particulate matter in the water column of rivers, the less light is available for benthic plants. This reduces their capability to photosynthesise, a process plants use to create glucose.

Site-specific water testing

To gather an understanding of the water quality in our focus location, we conducted a basic water quality test presented in Table 1.

Table 1.

Water quality measures at two sites within the focus location

Water parameter	Site one	Site two
Nitrate	7.67mg/L	7.68mg/L
Conductivity	191.2us/cm (Specific 257us/cm)	194.35us/cm (Specific 257.5us/cm)
pH	7.47	7.72
Dissolved oxygen	9.83mg/L 90.95%	10.86mg/L 101.55%
Clarity	66.63cm	73.25cm
Phosphorous	<0.2mg/L	<0.2mg/L
Temperature	11.95 degrees Celsius	12.42 degrees Celsius

Identical tests were conducted at two sites. Site two was approximately 500 meters downstream of site one and was done immediately after the site one tests (roughly the same time of day). Site one consisted of juvenile riparian vegetation (less shading), a soft riverbed,

mature benthic vegetation, and deeper water. In comparison, site two had relatively mature vegetation (increased shading), a rocky riverbed and shallower water. The turbidity at both sites was measured as 1.99 NTU.

The results presented in Table 1 show normal levels. These values were measured multiple times and averaged using Excel. In NZ rivers, nitrate should be below 11.3mg/L (Community and Public Health, 2023) and conductivity in freshwater is normally less than 1000 us/cm (DataStream, n.d.). The pH is close to 7 indicating its neutrality, which is beneficial for aquatic organisms (Fondriest Environmental Inc, 2013). The water has a high amount of dissolved oxygen and the temperature is cool. The clarity is moderate and the phosphorous is below 0.2mg/L.

This water quality test should be repeated at different times of day, during different seasons and at different locations along the river to draw strong conclusions from these tests. This is to adjust for changes in sunlight, seasonal fluctuations and different natural or anthropogenic processes along the river. These each affect the parameters measured and influence water quality. Therefore, adjusting for these will enable a greater understanding of the causal effects of different factors on the water quality of the Ōpāwaho-Heathcote River.

Due to the limited timeframe for conducting this research, our group analysed the phosphorous and nitrate together using a combined test. This technique has a minimum measurable concentration of phosphorous of 0.2mg/L which is rather high for rivers causing us not to obtain a specific value. If we had ample time to conduct these tests we would have done a separate test to measure this concentration.

Macroinvertebrate counts are also a tool used to determine the health of a river as an abundance of aquatic invertebrates corresponds to greater water quality. Again, however, due

to our limited timeframe and the requirement for advanced biological knowledge, we were unable to accurately calculate the macroinvertebrate community index (MCI).

Instead, we collected freshwater invertebrates using the kick sampling technique, preserving them in 70% ethanol. In the lab, we suspended our sample in water in a shallow rectangular container and sectioned off 12 sections. Then we rolled a dice to gain a random sample that we used to do a basic invertebrate classification and count under a microscope. Provided in Tables 3 and 4 is the raw data we collected.

Table 2.

Raw data count of freshwater invertebrates at Site One

Site one	
Classification	**Count**
Beetle Larvae	1
Freshwater worm	25
Water spider	1
Amphipod	4
Pea clam	1
Other fly larvae	1

Table 3.

Raw data count of freshwater invertebrates at Site Two

Site two

Classification	Count
Non-biting midge larvae	1
Freshwater worm	5
Amphipod	119
Pea Clam	4
Other fly larvae	1

There is a significant increase in the abundance of amphipods in our sample from site two (shown in Table 3) in comparison to site one (Table 2). This could be for several reasons such as better habitat, food sources, or less water contamination.

The Ecology of Native Vegetation

As part of our qualitative analysis, we interviewed Dr. Colin Meurk who is a highly regarded Landcare Research Ecologist and Conservationist. Meurk (personal communication, August 26, 2024) explained that NZ has had a unique local evolution due to its early separation from Gondwana, creating NZ's unique flora and fauna. He explains, that 75% of native woody plants produce berries or nectar that are essential food sources for many native bush birds. Particularly, he says, Podocarp (a type of conifer) are dry-cone bearing trees that have uniquely evolved in NZ to produce berries feeding these birds. Consistent with this, NZ native invertebrates, lizards, and fungi species also feed on specific flora. In comparison, 25% of exotic plants provide food for native fauna (Meurk, personal communication, August 26, 2024).

However, due to this isolated evolution, native vegetation is slow at evolving, and growing and is poorly adapted to reproduce Meurk (personal communication, August 26, 2024)

explains. This is due to NZ being a benign oceanic environment and, in the past, lacked the presence of land mammals and predators that speed up ecosystem processes due to their greater demands requiring faster regenerative capacity of vegetation (Meurk, personal communication, August 26, 2024).

Meurk (personal communication, August 26, 2024) described the Ōpāwaho-Heathcote riverside as urban riparian land that is a recombinant system of native and exotic vegetation. He says that although exotic vegetation is considered more aesthetic such as chestnut, Japanese honeysuckle and iris; to provide NZ's unique contribution to global species it is important to control invasive exotic species as these will dominate native vegetation.

Shade from riparian vegetation reduces water temperature fluctuations, enhancing instream habitat quality for aquatic species. Eels, in particular, he says, benefit from overhead shade and clear water. Riparian vegetation also reduces erosion by providing a buffer and protecting the land from water movement and heavy rainfall. This can trap sediment and slow downstream flooding. However, Meurk (personal communication, August 26, 2024) noted that many of the river's natural floodplains have been lost to urban development. Tī kōuka is recommended for riparian/wetland locations and podocarps further from waterbodies.

Roots influence soil structure and stability Meurk (personal communication, August 26, 2024) discusses. Tap roots penetrate deep into the soil column and provide greater strength whilst surface roots protect the grounds' surface. Fungi have a special influence on the fertility and productivity of soil. Particularly, mycorrhizas join to roots and mediate between the soil and vegetation, increasing soil nutrients and moisture. Similarly, microbes and invertebrates feed on the roots of trees further increasing soil fertility (C. Meurk, personal communication, August 26, 2024).

Leaf litter from vegetation in riparian locations is particularly a problem due to the leaves directly entering waterways, increasing soluble phosphorous (Hutchins et al., 2023). (C. Meurk, personal communication, August 26, 2024) discusses that exotic vegetation releases vast quantities of leaf litter within short periods (e.g. autumn) having a detrimental impact on oxygen demand in rivers due to their decomposition. In comparison, native vegetation is evergreen and sheds their leaves at a consistent rate causing the intensity of the impact to lessen.

Results and Discussion

Qualitative Interviews

Across the interviews, there was a strong emphasis on community engagement. Many felt that active involvement in local initiatives is essential for maintaining and improving the Heathcote River's health and biodiversity.

There was a common perception that aesthetically, a ‘colonial aesthetic’ is favoured in Christchurch, incorporating a landscape of mown grass and exotic trees like willows, with Interviewee 2 stating that “some people have a very colonial view of what the river should be”, and Interviewee 3 stating that the only benefit of mown grass landscape is the visibility of the river while pointing out that mowing the grass is an expenditure for the council, and there is a medium where incorporating benches and jetties allows those who want to view the river a place to do so while giving the surrounding landscape a chance to grow naturally.

Interviewee 3 expressed a strong interest in a developed cycleway running alongside the river, and preferring a walk/cycle path that follows the edge of the river rather than roads. Interviewee 4 also stating “it would be nice if there weren’t roads that ran along both sides of the river”.

Across all interviews, there was a clear priority placed on restoring and maintaining the river's health and biodiversity, such as Interviewee 2 saying "the more native trees the better". However, Interviewee 1 noted that "one is not going to be able to eliminate the fact that our ecosystem is a combination of native and exotic species", and Interviewee 3 stated "there are also places where exotic trees might have a role", referring to the shade that some exotic trees can provide (e.g. Fisher Avenue).

In the context of our research question, the results of this qualitative analysis show that there is a broad range of perspectives and varying priorities across the community. However, there is a consensus that improving water health and biodiversity is crucial. We used the themes identified in the interviews as the starting point to create questions for the survey.

Quantitative Survey:

Our Qualtrics survey was built on key themes identified from the qualitative interviews conducted with leaders from Beckenham community groups. This approach allowed us to create targeted questions of relevance that accurately reflect the community's aspirations and engagement with the river. The survey was open for two weeks and received 62 responses, 33 of which were from residents of the Beckenham community. The response rate provided us with a valuable dataset that allowed for the completion of a comprehensive quantitative analysis.

Connection and Observations

To gain an initial understanding of the respondents' connection and personal observations of the river the survey began by asking the respondents the following questions.

Q1. What suburb do you live in?

Q2. How long have you lived here?

Q3. Over the time you have lived here have you noticed changes in community care for the river?

Q4. In your opinion, how much has the quality of the Ōpāwaho/Heathcote river water changed in the past year?

All respondents held positive associations towards the river, with the majority describing it as a source of calm, relaxation, and happiness. This data supports the literature stating that riparian areas provide goods and services that enhance community well-being (Singh et al., 2021).

Among the 67 respondents, 33 were residents of the Beckenham community. Of the residents who had been there less than five years, 100% reported an increase in community care for the river, although they expressed uncertainty about any changes in water quality. Amongst the residents who had been there for over five years, they largely felt that the river's water quality had remained the same or improved in the past year, with 96.2% holding this view. Additionally, 92% of these residents believe that community care for the river has increased.

From these results, we can conclude that community care for the river in Beckenham has increased over the past year and the majority of residents have observed improvements in water quality. The scale of our project was too small to determine whether these improvements are directly attributable to the Beckenham native plantings. However, research

indicates that these plants can enhance water quality by reducing runoff and stabilizing sediment (Department of Conservation, 2005).

Safety

A key concern highlighted in our qualitative survey was the community's feelings of safety due to the density and height of established native vegetation. In the past, an area of riparian native vegetation was removed due to these concerns. This highlighted the importance of greatly incorporating a safety aspect into our quantitative survey to better understand the relationship between vegetation and perceived safety in the focus area. This approach allowed us to gather useful data for future decision-making in the riparian zone.

The initial question asked respondents to rate their overall feelings of safety in the riparian zone on a scale of one to ten; with one being very unsafe and ten being very safe. Out of the Beckenham respondents, 89.3% voted five or above. This suggests that the perception of safety is generally positive among the respondents, however, it is important to consider the remaining percentage as these respondents' perspectives could provide valuable insights into factors affecting community safety. When asked to explain what would improve their overall feelings of safety in a few words, the remaining group indicated that a continuous path separate from the road would make a significant difference.

To ensure that potential future safety improvements are focused in the right areas and that native vegetation supports community well-being, respondents were asked which locations along the Ōpāwaho-Heathcote River they would prefer to spend their time. All respondents who had safety concerns selected The Donkey Track and Ernle Clark Reserve. Both of these

locations have experienced native plantings, much of which is well established. This data revealed that the concerns around safety do not stem from native vegetation obstructing the view from the street to the track.

Figure 2 illustrates the total responses from Beckenham respondents regarding what would improve their overall feelings of safety. This data shows that a walkway, reduced car speed limits, and improved lighting would most greatly enhance the community's feelings of safety in the area. This data revealed that the concerns around safety do not stem from native vegetation obstructing the view from the street to the track. This further emphasizes that the community's safety concerns are less focused on vegetation. Instead, the respondents are more focused on improving safety through infrastructure.

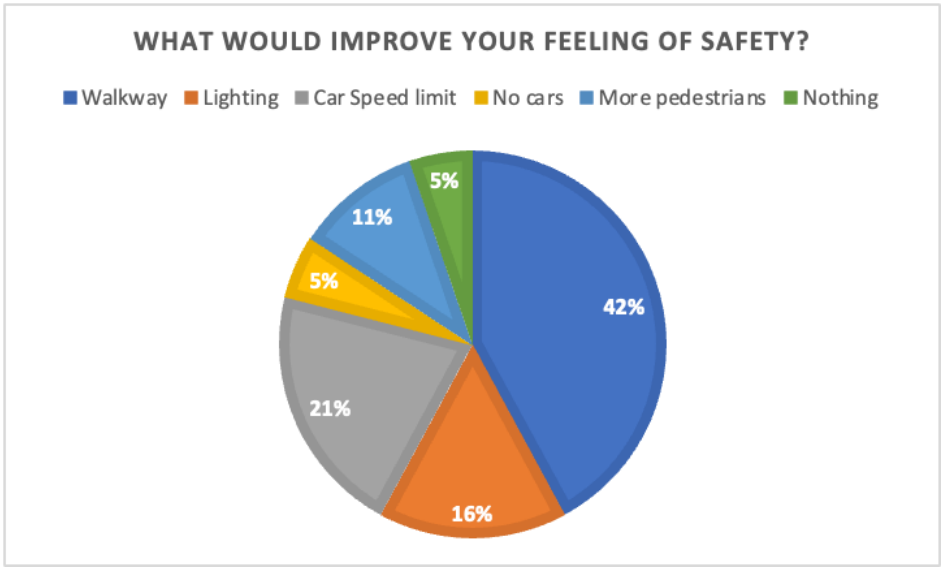

Figure 2. Beckenham Community's Safety

Vegetation and Aesthetics

Among the Beckenham residents, 89.3% expressed a top preference for an established native bush corridor along the entire focus area. 10.7% of the remaining respondents stated they

preferred Grass lawns or exotic plants such as willows as they were more aesthetically pleasing. However, this group added that if they were informed a less appealing option better impacted the health of the river and riparian area, this may influence their preference. This reflects a growing awareness of ecological priorities amongst the Beckenham community.

57.1% of respondents stated that community plantings in the riparian zone have led to increased community engagement with the area. Out of those surveyed, 40% indicated that they participate in these plantings, demonstrating the community's recognition of the importance of native restoration projects.

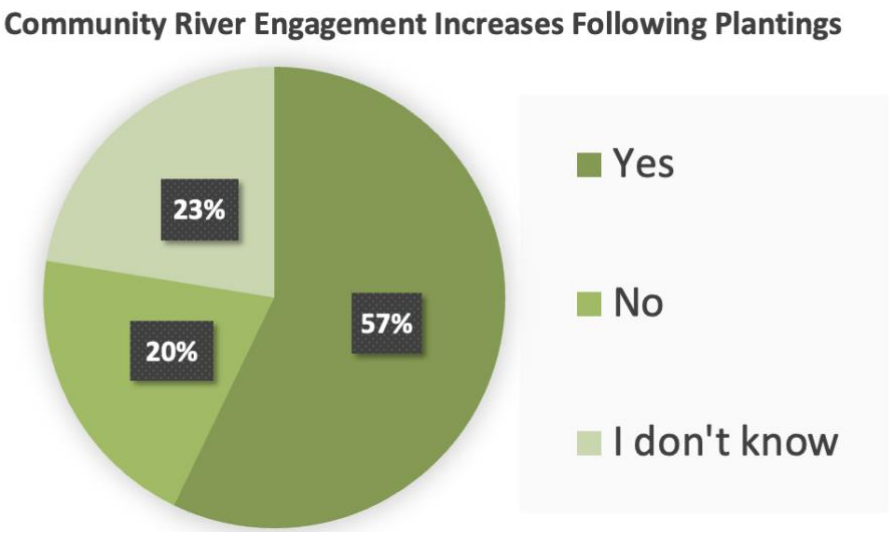

Figure 3. Community Engagement Post Plantings

River Ecology Education

Meurk, (personal communication, August 26, 2024), expressed his concerns with the education system's failure to incorporate ecological literacy into its curriculum. He explained the urgent need for mainstream education to develop an understanding among students of the

natural environment and its interconnectedness. The quantitative survey showed the Beckenham community's alignment with this perspective as 92.3% of respondents suggested that incorporating the river ecology and history into the local curriculum could be a method of enhancing community connection and care among the community.

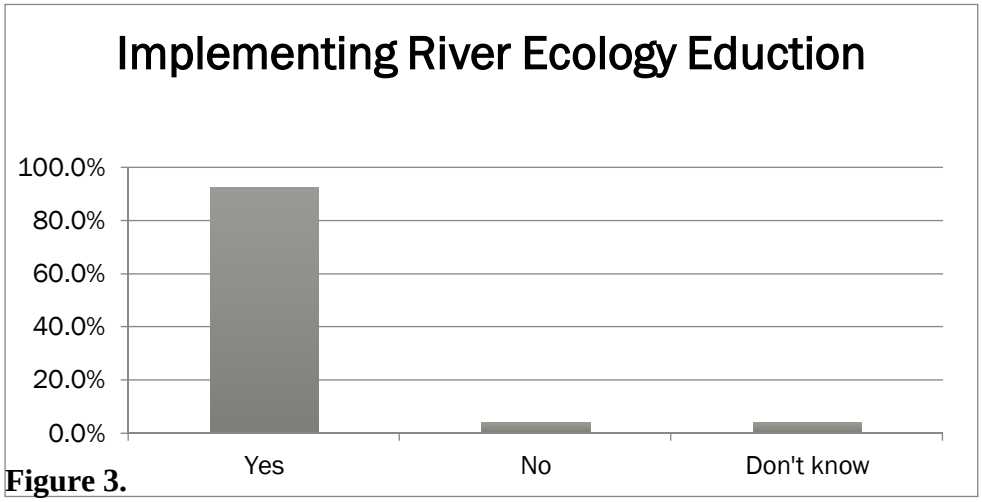

Figure 3.

Community Support for River Education in Local Schools.

Limitations

A limitation of this research is that most respondents to the Qualtrics survey were from a specific local community group whose leader distributed the survey. As a result, the data may primarily reflect the perspectives of those who are more environmentally conscious and aware of water related issues, and may not represent the wider Beckenham population. Future research should focus on distributing the survey to a broader group of residents for more comprehensive insights. This could involve sharing the survey at local libraries or weekend farmers' markets. Another consideration was the limited number of interviews (four) conducted due to time and resource constraints. Expanding interviews to include perspectives from others, such as Tangata Whenua, could provide additional insights.

Discussion/Recommendation

The qualitative and quantitative analyses show consistent themes and results. Much of the community shares a similar connectedness to the river and aspirations for the riparian land. In particular, all of the interviewees and 87.5% of the respondents were in favour of a native bush corridor. However, a common theme from the qualitative analysis was that varying preferences in land use that must be considered. For example, areas of low crops that provide views and access to the river or more open spaces for safety. Therefore, we recommend incorporating these aspects into the focus area. The inclusion of park benches, areas of lower-lying vegetation and native vegetation along this section would suit these community members well. Most safety concerns were centred around the lack of footpath, seating or inadequate lighting so addressing these concerns in future planning is recommended. the These features would provide spaces for people to rest and enjoy the river while also meeting aesthetic preferences and offering habitat for New Zealand's unique fauna.

We recommend that future research create and distribute a visual representation of a plan for the riparian land using ArcGIS based on the community's needs. This is to ensure the plan is representative of the wider Beckenham communities aspirations. We also recommend regular water testing at various sites along the river to better understand its health and any potential changes. This will enable a more definitive conclusion on whether native riparian corridors affect the local nutrient concentrations of the river. Additionally, soil tests would also be beneficial as native vegetation can grow in low-fertility soil where excess nutrients can be harmful (Hewitt, 2007).

Conclusion

This research project explored the Beckenham community's connection to and aspirations for the Ōpāwaho-Heathcote River and its surrounding riparian area. Data was collected using a mixed-methods approach, which included insights and perceived priorities of key community leaders and validation of these through quantitative interviews with the broader community. The qualitative interviews identified themes such as community safety, ecological awareness, vegetation impacts, and the community's connection to the river. Analysis of the quantitative survey revealed that these themes were also of high importance to the wider community, with the majority expressing strong support for native riparian bush regeneration, the implementation of ecological education and infrastructure developments aimed at enhancing community care and comfort regarding the Ōpāwaho-Heathcote River.

Acknowledgements:

We would like to thank our community partner James Beck and our supervisor Rachel Teen for their assistance during this research project. Additionally, we would like to thank our interviewees for their time, insights, and knowledge as well as the 63 respondents of our survey.

Glossary

NZ – New Zealand

Appendix

Table 4.

Timetable of conducted interviews

Interviewers	Date	Time	Interviewees	Interview Location	Health and Safety Contact
Sophie and Erykah	16/08/24	2:30pm	Interviewee 1	South Library	Kezia
Harriett and Erykah	22/08/24	10:30-11:30 am	Interviewee 2	University of canterbury	Kezia
Harriett and Erykah	26/08/28	2:30 pm	Interviewee 3 and 4	Online via zoom Room 902 in the library	Kezia
Harriett and Erykah	26/08/24	12 pm	Colin Meurk	University of Canterbury	Kezia

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