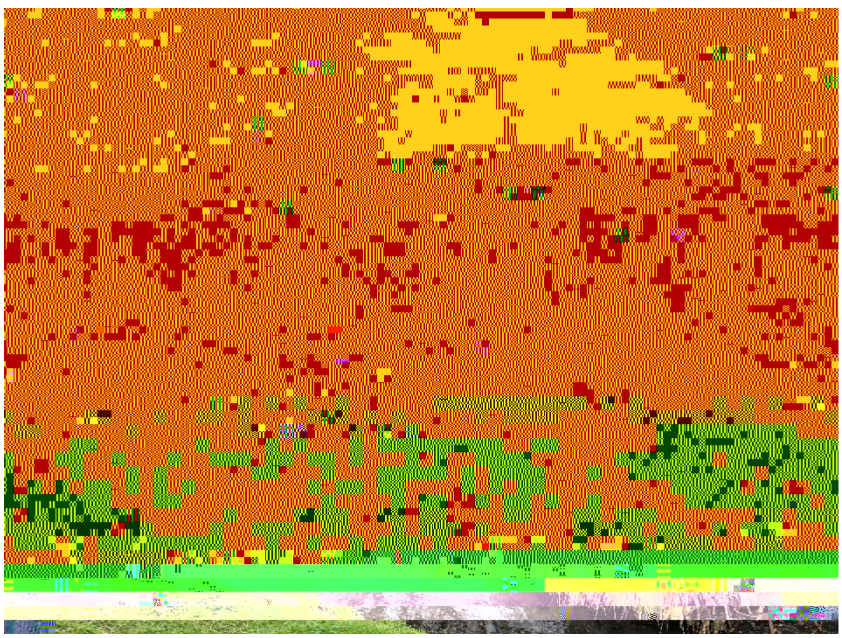
More Th 0a Drain: Improving the health of St Albans Stream through riparian planting methods



A community research project partnering with the St Albans Residents Association and GEOG309 to enhance the quality of the much-loved Abberley Park

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Executive Summary

St Albans Stream runs through Abberley Park, in St Albans, Christchurch. The park is an attractive, biodiverse greenspace. However, locals are concerned about erosion and water quality.

We collaborated with the St Albans Residents Association (SARA) to investigate what native riparian planting methods should be applied in Abberley Park to improve St Albans Stream health. Enhancing green and blue space through riparian planting benefits wellbeing, stream health and community resilience. Using indigenous species, deep planting and mulching techniques improves the success of plantings.

We engaged Rehua Marae and acknowledged a recent survey on the public perception.

We measured conductivity, pH, dissolved oxygen, and macroinvertebrate community index (MCI). The MCI indicated poor stream health. pH and dissolved oxygen were within an acceptable range.

We observed local bank conditions and vegetation cover. Upstream sections in Abberley Park with high canopy cover need to be planted in shade tolerant native species. Downstream sections with low canopy cover require dense planting of sun-tolerant species.

There were limitations with data collection, available literature and community engagement.

We suggest future research looks at continuing water monitoring, plant maintenance and community engagement. Future research should aim to expand water and bank assessment measures, continue Investigating public perception native plantings in heritage parks, analysing new stream enhancement techniques.

1. Introduction

Abberley P heritage parks and is highly valued for its social, cultural, and ecological values. It is located north of the Central Business District in . Abberley Park has beautiful green space which attracts native birds such as the

an abundant resident species of monarch butterfly which is highly valued by the community. This emphasises the importance and value of the green- and bluespaces in Abberley Park. The stream, however, suffers from poor water quality. It was important for research to be conducted to find ways to improve the stream health, so the local community can continue to enjoy the scenery at Abberley Park.

The St Albans community are concerned about the streams water quality. Respondents from a survey conducted by Blundell-Dorey et al. (2022) highlight the publics negative perceptions on the maintenance and health of St Albans Stream. People interviewed mentioned that mud, rubbish and stormwater discharge is reducing stream health. Overall, *g*reen infrastructure is well supported in Abberley Park, but blue infrastructure is not.

Our GEOG309 group conducted research in partnership with Emma Twaddell and Shamani Gill from the St Albans Residents Association (SARA). SARA is a community run organization

their objectives is to encourage activity that will benefit the welfare of residents in St Albans (SARA, n.d.). A way to do this is to improve the water quality in Abberley Park, specifically St Albans stream which runs through912 0 612 792 re-4(ca)8(l)93 7<0052005S20009.0000091

The St Albans Residents Association have the 100-year anniversary of Abberley Park in 2040 and would ideally like the stream to have improved water quality by then. Therefore, there is 18 years to build and implement a plan for the stream. Urban stream health is not only important for its looks. Aquatic life (plants and macroinvertebrates) would also thrive with better water quality. The health of the water in a stream directly influences how well the aquatic life can grow and reproduce (US National Park Service, 2022). Therefore, this research is important to investigating solutions for the poor health of St Albans Stream.

2. Research Question

The research question decided on is: What native riparian planting methods should be applied in Abberley Park to improve St Albans stream health? The aim of this question is to provide guidance to SARA on riparian species selection, planting methods and maintenance. Identifying the benefits of riparian planting on stream health and community wellbeing will also be investigated.

Riparian planting was chosen due to the indication by Emma Twaddell and Shamani Gill that the lack of bank stabilization was a key factor in the degraded stream health. There is often partial collapse of the sides especially after heavy rain. Riparian planting will decrease erosion and sedimentation, improve water quality, and improve ecological health (Soeter, 2020).

This research question builds on previous research conducted by Blundell-Dorey et al. (2022). This study addresses two recommendations from the report. The first being additional research is required to identify , to identify which species would be of best fit for planting. taken on board in this project to identify the riparian planting species, methods, and locations for the section of St Albans stream in Abberley Park.

3. Literature review

For our literature review we had five sub-themes: plant species selection, riparian planting methods and maintenance, greenspace and bluespace, community engagement and stream health. We chose these sub-themes because they relate to improving the St Albans stream health and align with interest to improving Abberley Park while having the community engaged in the process.

Plant species selection is vital to ensuring the riparian buffer improves stream and ecological health. Riparian planting methods and maintenance are needed to ensure the long-term effectiveness of the riparian buffer, reducing the risk of failure and need to replant. Knowing the benefits of greenspaces and bluespaces justifies why we are adopting riparian planting. Community engagement is important to ensure that stakeholders of our project get their ideas and opinions heard and to ensure they are onboard and included with what we are doing. Stream health measures gauge the physical, ecological and chemical conditions of St Albans stream and assess how riparian planting might improve these factors.

3.1 Plant species selection

This review considered the species selection along the banks of the stream with the focus on bank stabilization To select species for riparian planting in Abberley Park, the design and metho reduce soil erosion (Dreesen et al., 2008). If the right shade-tolerant species are used, seedling survival can improve by 70-85% (Sweeney, 1993).

Increasing density, diversity and stratification increases riparian planting success and water quality (Jo et al., 2014). Wider riparian buffers are more effective at improving water quality. In Abberley Park, the width of the riparian buffers should be at least five meters. (Parkyn et al., 2000).

Riparian buffers in urban zones are more prone to invasive species which reduce the riparian buffers effectiveness at improving stream health (Loewenstein & Loewenstein, 2005). We have planned to use biodegradable herbicides to spot-spray weeds with minimal impact to the riparian planting (Department of Conservation, n.d.). Mulching the soil is recommended before planting to remove weeds and grasses (Jo et al., 2014). Diseased plants need to be constantly replaced to maintain vegetation density (Department of Conservation, n.d). Canopy cover reduces the growth of grasses which reduce plant competition (Moore et al., 2011). Therefore, shady sites require lower weed management.

3.3 Greenspace and bluespace

Blue and Greenspace are used in an urban context. Bluespace includes outdoor water features like streams and greenspace includes vegetated areas like parks. While

sediments ~1m up stream. To accurately represent the habitat conditions we sampled 2 sites under canopy cover and 2 from the exposed reach. All material was preserved in a 2:1 ethanol and stream water solution and processed 2 days after collection.

Processing each sample individually, a 500µ sieve was used to separate out excess material such as leaves. The contents of the sieve were put in a tray with water and specimens were identified by eye then examined under a microscope to determine species when possible. From this an MCI and species richness were calculated for each site.

5.2 Water quality sampling

To supplement MCI data and provide more insight on the drivers of stream health we measured physical water quality parameters. A Hach water quality instrument measuring pH, conductivity, and dissolved oxygen (DO) was used to measure water quality parameters. Three readings of each parameter were taken at each sample site, this was averaged for each site to remove sampling error.

5.3 Site description

We conducted a habitat assessment to describe each of the four sites.

We recorded Latitude and Longitude using an eTrex® 10 GPS receiver. Co-ordinates are displayed in WGS 84 format and mapped in Google Earth (Figure 2).

Instream habitats are classified as a riffle, run or pool. Pools are slow, following eddies. Runs and riffles indicate flowing water, runs have smooth water flow and riffles have turbulent surface flows. Stream substrates were classified as either mud, silt, gravel, or pebbles.

Bank slope was categorized as flat, moderate, or steep. The bank width is the maximum realistic width of the riparian margin. Measurements were made for the right tributary (right side when facing downstream) and left tributary.

Plant species were identified and categorized as groundcover or canopy species. Canopy and groundcover were also observed. Canopy cover measures the percentage of canopy overhanging the stream. Groundcover indicates the percentage of the streambanks that are vegetated. In addition, plant species identified by INaturalist users near our study sites were listed (Table 2).

tolerance for sun and shade and distance from the waterway (Figure 3). Species with Mahinga kai significance as indicated by ECan, (2022) are noted.

Figure 3. Zonation of plants based on distance from waterway. Lower bank species are right next to the river, upper bank species can tolerate flooding. Crest or upper terrace, where plants are above usual flood levels (Lucas associates, n.d.)

6. Results

6.1 Water quality

Table 1 shows water quality has low variability across sites. This was expected as the stretch of stream is no more than ~150m and dependent on surrounding anthropogenic activities. The pH of the water is slightly basic but is within the 6.5-8.5 allowable range set out in the Canterbury Land and Water Regional Plan (Environment Canterbury, 2018). DO levels were great for supporting pollution sensitive aquatic life. This indicates factors that affect DO: temperature, organic matter, and flow, were at sensible levels

origin. Our conductivity measurement suggests that the water is rainfall and surface runoff dominated, with some input from Waimakariri River seepage (Hayward, 2002). There is a moderate level of ions leached from the land surface and aquifer material (Cawthron, 2022).

6.2 MCI and species richness

Table 1 also

Sites two and three had the muddiest substrate. Sites one and four had gravel substrates. Paths near these sites likely contributed to this. Site one was the only riffle habitat, all other sites were classified as runs.

Sites one and two have high groundcover but low canopy cover. This is because the wide riparian buffers are mostly grassed down to the edge, but few mature trees are present. Sites three and four have low groundcover, but high canopy cover. Understorey vegetation is low, particularly on the left tributary, but canopy cover is high, particularly at site three. Deciduous plants dominate the canopy at sites one and four, so canopy cover should increase in summer. Slopes are steep on the right side and gravel driveways limit riparian width.

Figure 5. Photos of stream sample sites in Abberley Park; a) Site one b) Site two c) Site three d) Site four

6.6 Plant Species Selection

Suitable species for planting are listed in Table 3. Sun tolerant species suit sites one and two, while shade tolerant species suit sites three and four. Species are further divided into three zones: margins, banks, and terraces, which map the distance from the waterway those species best suit. Plants already found along St Albans Stream (Table 2) match the plants recommended (Table 3). Therefore, these plants can grow successfully.

Table 3. Species appropriate for each site and zone (Christchurch City Council, n.d.; Lucas Associates, n.d.). Species that have cultural and Mahinga kai significance are marked by an asterisk (ECan, 2022)

Sites	**One and Two (sun tolerant)**	**Three and Four (shade tolerant)**
Margin **<.5 m from stream**		

6.7 Limitations

Throughout our project there were limitations we came across which could be considered for future work on the St Albans stream.

1. The lack of experience in measuring the MCI value in the stream could much improved. This was evident in identifying species, as was the case in site 3 where a caddisfly was misidentified as a stonefly species.
2.

7.2 Water Monitoring

Water quality testing confirmed the poor ecological state of the stream. Riparian planting will have the greatest impact on biodiversity and bank stability, as it has at comparable sites where enhancement projects have been undertaken (Suren & McMurtrie, 2005). To assess whether riparian planting is improving stream health, it is advised to continue monitoring the MCI and physical parameters. Improvement can then be detected by comparing it to baseline data. The MCI is the better method and can be done annually. However, physical parameters are an easy alternative, provided measurements are conducted seasonally. Continued monitoring could involve the community, building awareness and increasing the value placed on the stream within the local community.

7.3 Planting and maintenance methods

Effective preparation, planting techniques and W* ni 11.04 T 612 792 rq2970000912 0 612 792 reW* n-4(he)9(l)-4(oc)9(

8. Future Research

Questions raised by this project that could be the aim of future work include:

Measure bank conditions parameters e.g., compactness, soil order, soil pH.

Expand water quality parameters measured e.g. salinity, nitrates

Investigating public perception of exclusively native planting in a heritage park

Improving the instream habitat with other stream enhancement techniques

9. Conclusions

We have recommended native riparian planting methods that should be applied in Abberley Park to improve St Albans stream health. This includes plant species and methods to maintain them. We conclude that site one and two should be of highest risk of erosion and bank instability. It is recommended that species selection match shade and water tolerance by

ECan. (2022, October). .