INVIGORATING LATIMER AND SOUTH EAST THROUGH BLUE-GREEN INFRASTRUCTURE

Planning for urban liveability around Te Kaha / Canterbury Multi-Use Arena

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GEOG402

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Executive Summary

Urban liveability is an ongoing challenge faced by developers. For example, the Te Kaha / Canterbury Multi-Use Arena is set to be constructed in Latimer and South East, Central Christchurch. This research project seeks to provide recommendations for the Christchurch City Council, answering the research question: *What amenities need priority development to respond to the increased population density of Latimer and South East areas of Christchurch's inner-city?*

Four key methods were used for this research, the first of which was a literature review. The following four themes were chosen and thoroughly researched to be applied to the recommendations provided:

- Effective utilisation of blue-green infrastructure
- Urban form and accessibility
- Mobility, motility and amenities
- Encouraging investment

The second method used was a spatial mapping of the study area using geographic information systems (GIS). Again, data from various sources were mapped to convey the current state, providing insight into locations that could be improved or further developed. Finally, the third method, observational data, was used to visually confirm the mapping of amenities to ensure that data used was up to date.

From this methodology, three recommendations were identified for the Christchurch City Council:

- Micro-greenspace development
- Area for future park development
- Cycle lane extension

It was concluded that the amenity most in need of priority development are greenspace, as there are co-benefits for physical wellbeing, mental wellbeing, and business investment.

Introduction

Urban areas around the world are undergoing rapid intensification. Otautahi Christchurch is no exception, with the number of residents growing from 341,469 in 2013 to 369,006 in 2018 (Stats NZ, 2018). In recent years, the city has undergone several stressors, from the earthquake sequence in 2010/2011 to a terrorist attack in 2019. Resilience is essential for communities to overcome shocks and stressors and should be prioritised through planning and development. The Christchurch City Council (CCC) seeks to guide development and urban intensification in central Christchurch, including Latimer and the South East suburbs. With intensification predicted around the Te Kaha / Canterbury Multi-Use Arena (Te Kaha) development site, the CCC aims to increase the number of residents within the central city from 8,080 to 20,000 (Christchurch City Council, 2018). This report seeks to answer the research question: *What amenities need priority development to respond to the increased population density of Latimer and South East areas of Christchurch's inner-city?*

Definitions

Greenspace

Greenspace in an urban context is any publicly accessible area such as parks, wetlands, and vegetation (trees or plants) that are part of the built environment (Lachowycz & Jones, 2013).

Bluespace

Bluespaces are attractive bodies of water such as lakes and rivers that are accessible to the public.

Amenities

Amenities refer to a publicly serving feature or facility that provides enjoyment, value, or a service to the community or space.

Resilience

Urban resilience is the capacity of a city's systems, businesses, institutions, communities, and individuals to survive, adapt, and grow, no matter what chronic stresses and acute shocks they experience. (Mackinnon, 2015).

Background

Construction of Te Kaha is set to begin in 2026. The CCC approved the preliminary plans to hold 36,00 spectators for music events and 30,000 for sporting events (Christchurch City Council, n.d.). Building Te Kaha will complement the reopening of international borders following the COVID-19 pandemic, as it will increase Canterbury's ability to host national and international events. Ideally, events will promote economic investment in surrounding infrastructure such as accommodation, food establishments and commercial businesses. The surrounding suburbs are Latimer and the South East.

Currently, the CCC has several streets scheduled for an upgrade by 2025 to coincide with the completion of Te Kaha. The streets are as follows (Christchurch City Council, 2022):

- Lichfield Street (between Fitzgerald Avenue and Barbadoes Street).
- Tuam Street (between Madras Street and Fitzgerald Avenue).
- Barbadoes Street (between Hereford Street and Tuam Street).

- Madras Street (between Tuam Street and Latimer Square).
- Madras Street (between Moorhouse Avenue and Tuam Street).

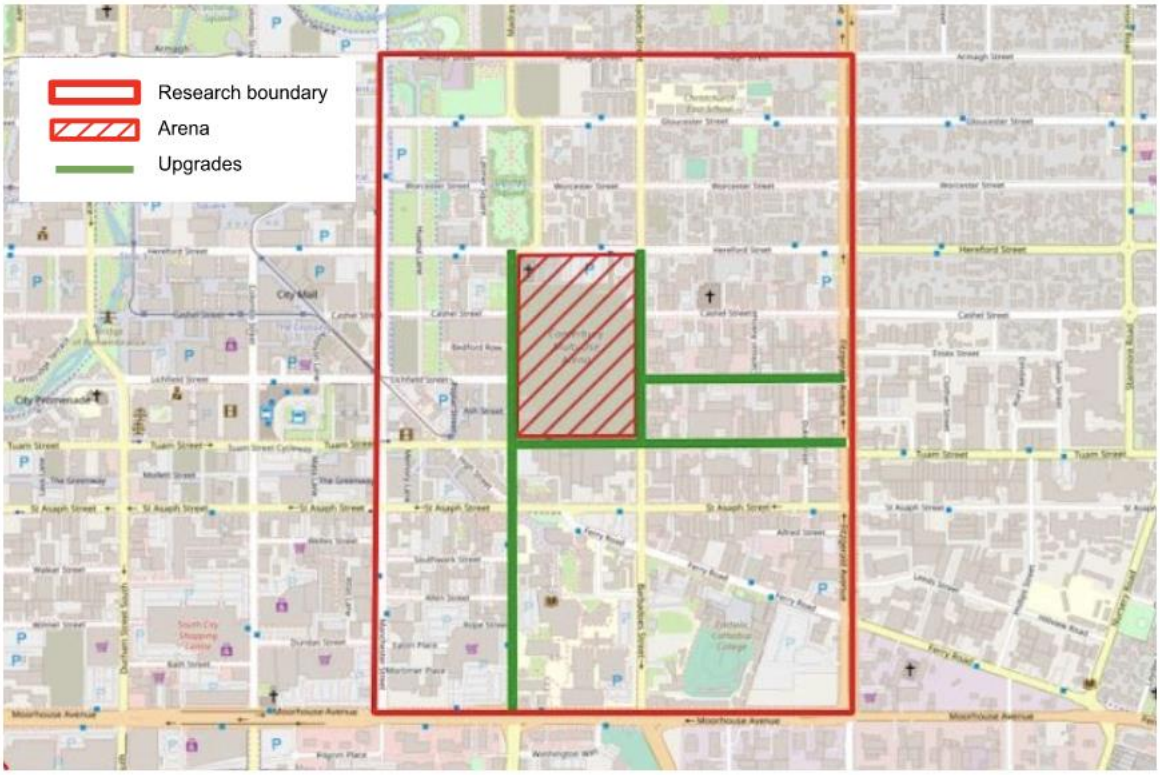

Figure 1: Streets scheduled for upgrades to increase walkability of the area are highlighted green around the proposed Multi-Use Arena, according to the CCC Draft Annual Plan.

Latimer Square is a public greenspace which holds historical significance. The name represents the relationship between the Anglican Church and the European founders of Otautahi Christchurch (Christchurch City Council, n.d.). The square is 18,118m^2 and consists of grass, trees and concrete paths (Christchurch City Council, n.d.). The Ara Institute of Canterbury (Ara) and the National Academy of Singing and Dramatic Art (NASDA) within the South East. Due to this, a student demographic is expected (Christchurch City Council, n.d.).

With the suburb being located close to the Central Business District (CBD), it is presumed that the number of residents will increase in the coming years. Public knowledge assumes that the completion of the Te Kaha will inspire more urban development in the area. Land in the lightly industrialised area is relatively cheap in value, so this will likely be the location of future urban development.

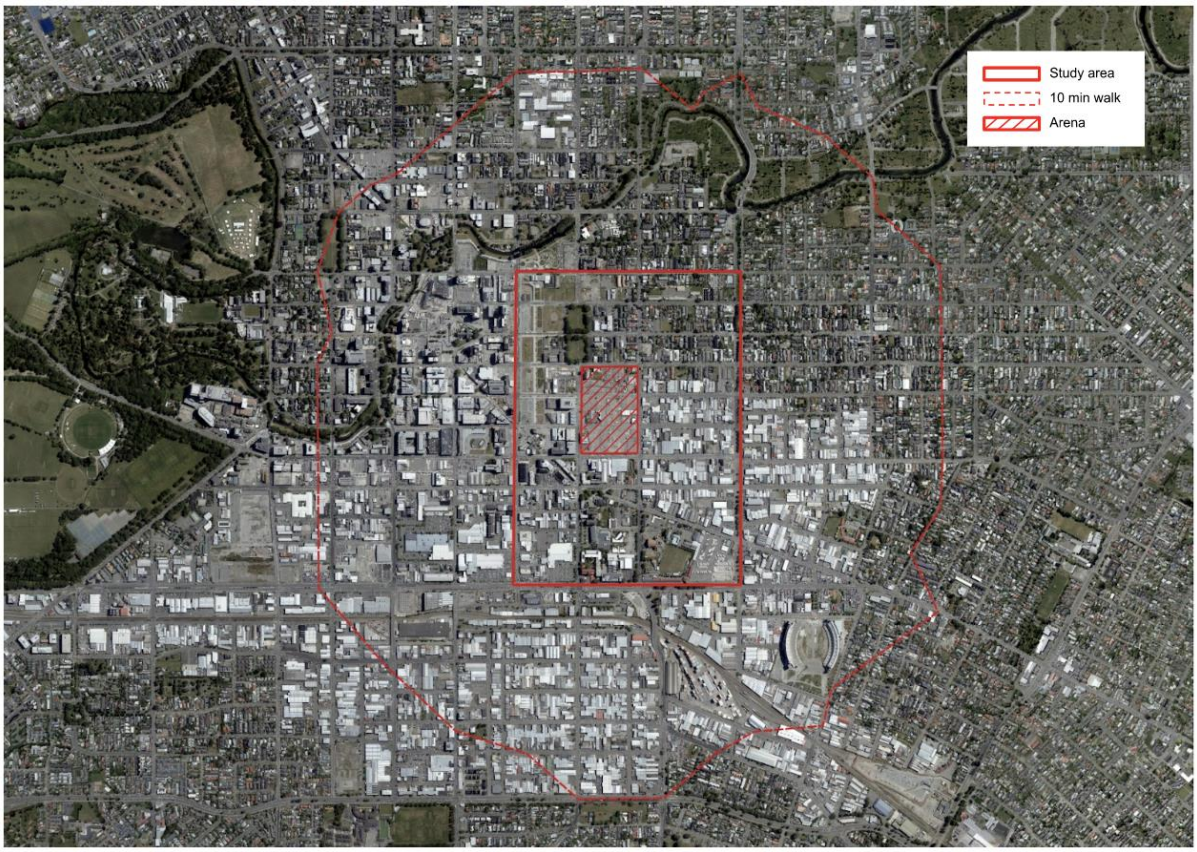

Figure 2: The Geographical context of the study area within the red box is the study area, Latimer Square and South East.

Current amenities within the study area consist of food and entertainment establishments and supermarkets. Several essential amenities in the surrounding perimeter include medical clinics, primary schools, and a police station. Larger greenspaces exist within the Latimer and South East suburbs, such as Latimer Square and Rauora Park; however, bluespace and micro-greenspace are lacking. The South East has an 'industrialised feel' and differs from surrounding residential neighbourhoods. The industrial areas have low vegetation cover, wide streets, and little aesthetic street value. In comparison, northern residential areas have high vegetation cover and high aesthetic street value. The South-East corner of the study area is currently a light industrial area with a lack of residential infrastructure (Christchurch City Council, n.d.).

Methods

Method 1: Literature Review

The first method used in this research report was a literature review. Four themes were identified and researched to inform recommendations around what amenities need priority development in the study area. A combination of online resources, government websites, books, and peer-reviewed journal articles was utilised from Aotearoa and the international context. The four themes are depicted in the list below:

- Effective utilisation of blue-green infrastructure
- Urban form and accessibility
- Mobility, motility and amenities
- Encouraging investment

These themes were selected to best answer the research question following consultation with the project's community partner (Laura Quaid - Christchurch City Council) and research supervisor (Dr. Rita Dionisio).

Method 2: Spatial Mapping

Information mapping through geospatial information systems (GIS) was used to establish the current infrastructure state of the study area. Multiple data gathering techniques and mapping styles were employed to illustrate the current spread of permanent greenspace, bluespace, residential serving amenities and public access ways.

Scope

The relevant data types were established early to direct the data mining process. A 'ten-minute' walking boundary was established around the study area, as shown in *Figure 3*, to limit the scope of data collection. This border depicts an 800-metre distance, measured from the most external point in the study area, travelled along with the street networks. GIS distance measurement tools were used along alternate network routes to establish the minimum possible boundary around the study area.

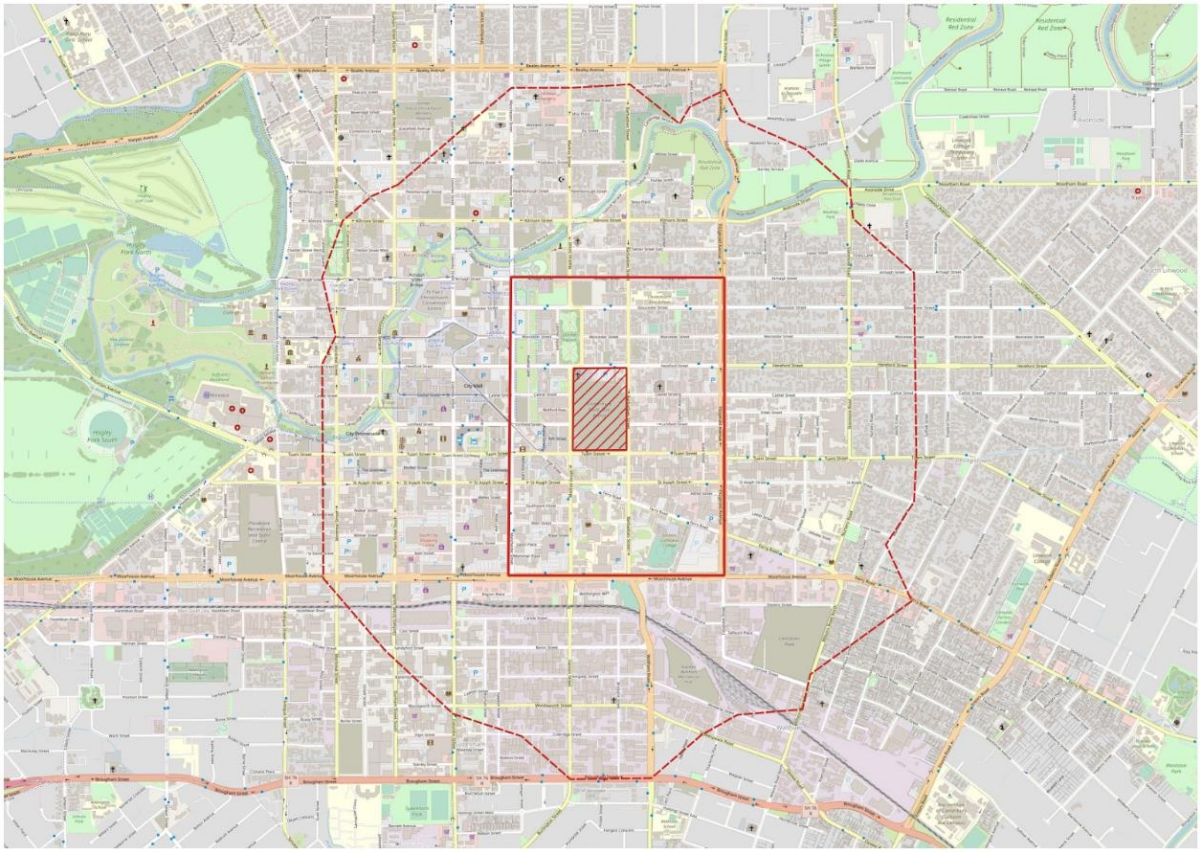

Figure 3: A ten-minute walking boundary was measured from the furthest edge of the study area.

The categories of mapped services/amenities were:

- Medical Clinics
- Police Stations
- Primary Schools
- Supermarkets
- Bars

- Cafes
- Food Establishments
- Libraries

Retail and commercial establishments were not included in this list as they do not service needs, more generally servicing wants and luxuries. Although bars, cafes, and food establishments can also be seen as luxuries they were included in this study because they encourage community vibrancy by providing social gathering places (Mehta, 2007).

Temporary park space was not included as greenspace due to its short term outlook. The size of greenspace ranges from roadside green strips and rain gardens to fully functional parks. Public access routes included roads, cycleways, bus routes and pedestrian walkways.

Data acquisition
Once the required forms were defined, the data gathering took place. Amenity location data was gathered through open-source, observational, and accessing already collected amenity data through the University of Canterbury Civil Systems team. Open-source data was gathered from OpenStreetMap (OSM) (n.d.), Google Maps (n.d.), and the CCC data portal (n.d.). Locations of amenities found in OSM were cross-referenced with Google Maps and vice versa. Point source information established through open-source data was verified against an existing database of public amenities collated by the Civil Systems research team under Dr Tom Logan. The location of transport services such as bus routes, bus stops, and cycle lanes was sourced from the CCC website and transcribed into multiline shapefiles.

Greenspace data was visualised through remote sensing and satellite imagery. Open source satellite libraries, Sentinel Hub and Google Earth Engine databases were investigated to find recent high-resolution images of the Christchurch CBD.

Data gathered through these methods was then verified by primary observations. Due to the magnitude of data collected and the expansive study area, not all data points could be verified through observational data. Importantly, high-density amenity areas were observed with photos and notes on mapping accuracy.

Mapping
The data gathered was then uploaded into the program QGIS to be cleaned and visualised. Geospatial data was overlaid on a basic OSM map for visualisation, and satellite imagery was edited with bandwidth filters to highlight vegetation cover. The map outputs can be found in the results section of this report.

Method 3: Observational Data

Observational data was used to verify open-source data and provide topological context to the urban layout. The urban form of high amenity areas was noted and compared to low amenity areas. Primary data gathered included; written notes on street/area features and social culture, pictures of urban form and gathering spaces, and videos of urban form and activity. This was gathered by driving through and walking around the interest areas. Drive-by observations were made of low-density amenity areas. Areas observed were as follows:

- The two blocks between Colombo Street

- Madras Street above and below St Asaph Street
- Latimer Square and the river corridor
- New Regent Street
- Tuam Street from Barbados Street to Stanmore Road
- Stanmore Road between Gloucester and Worcester Streets.

Literature Review

An extensive literature review was conducted to investigate how the CCC can create a multifunctional space around the arena that promotes sustainability and usability for a diverse range of people. The themes of the literature review investigated what amenities could be built. It also investigated what factors of mobility and functionality are needed when designing the space around the arena.

Effective utilisation of Blue and Green Infrastructure

Unleashing cities' transformative capacity for sustainable urbanisation will be a significant challenge in the twenty-first century (Bruckner et al., 2022) while simultaneously addressing economic development and social fairness (Roberts et al., 2017). Blue-Green Infrastructure (BGI) has become one of the most critical strategies cities use to achieve sustainable development. The characteristics of BGI are either green vegetation or blue water (Kimic & Ostrysz, 2021). BGI consists of natural and semi-natural systems to be implemented in urban design that mitigate climate change, promote better accessibility and increase health and wellbeing. Furthermore, effective BGI requires the spaces to be multifunctional and designed around the stakeholder needs whilst being sustainable and resilient. These fundamental concepts are critical in identifying and planning appealing developments for modern urban greenspace.

Senik and Uzun (2022) state that the most effective greenspaces are multifunctional. The usability of these areas will rise if they bring social, economic, and environmental benefits. As such, the compact city model has modified the role of greenspace in an urban centre (Fuller et al., 2007). Greenspace serves as a positive relationship between health and nature. The Ebenezer model by Jim & Chen (2003) extends on this idea by stating that 21st-century urban centres require greenspaces to be multifunctional. The lack of available space in urban centres has led to greenspaces needing to be multifunctional. For example, a park can serve multiple purposes, such as recreational activities, assembly points in times of disasters, or act as walkways between built-up areas (Peters et al., n.d.). A strong relationship between sustainability and urbanisation has emerged from this model. Jim and Chen (2003) discussed how it provides cities with an opportunity to create more sustainable and resilient cities without giving up valuable space for single-purpose greenspace. As cities become increasingly more urbanised, the effective utilisation of multifunctional greenspaces will allow a city to be sustainable and provide natural amenities to promote health and wellbeing without compromising on space for other systems such as transport and climate change mitigation.

According to Shi and Woolley (2014), designing BGI and creating these spaces in urban areas is insufficient. Instead, BGI needs to be tailored to the stakeholder's needs and be integrated into these areas that provide services for long-term use (Shi & Woolley, 2014). Planning for BGI requires consultation on the needs of the people, support for the people's

desires, and active collaboration with the people to ensure the space caters for the people who will use it. As such, stakeholders will be an essential part of creating spaces as their influence contributes towards what areas need BGI for it to be purposeful.

Recent research has shown that urban surface waters can positively impact human health and wellbeing. Urban surface waterways, such as coasts, rivers, and lakes, have gained momentum in urban planning under "waterfront rejuvenation" (Bruckner et al., 2022). Environmental, social goals and excellent economic prospects are among the different benefits of the regeneration of blue areas. Multifunctional spaces might also feature blue zones. Kimic and Ostrysz (2021) investigate how 19 blue-green infrastructure solutions have helped communities become more resilient, notably in stormwater management. Their findings imply that a comprehensive approach is required for a successful blue-green infrastructure.

The impacts on the quality and viability of cities are design, administration, open areas, and the urban green areas' upkeep. At the same time, good quality greenspace is essential for increasing the quality of urban living. By giving people a place to rest, exercise, play sports and socialise, the area becomes more pleasant to live in (Shi & Woolley, 2014). Moreover, building blue and green areas necessitates finding ways to connect fundamental ecological challenges with regionally significant social and economic issues. If developed correctly, BGI contributes to a city's resilience by facilitating social interaction, health and wellbeing, recreation and mitigating climate change.

Urban Form and Accessibility

Urban form refers to the physical characteristics of anthropogenic built-up areas, such as the shape, size, density, and configuration of settlements. It can be considered at different scales, such as regional, urban, neighbourhood, 'block', and street. Urban form influences the way people move through a city, what amenities are used, and how communities interact (Jacobs, 1961; Gehl, 1989). Therefore resilience is inextricably linked with urban form in cities. While facing future challenges like climate change, globalisation and urban intensification, an urban form will influence communities' ability to endure and respond. Well-designed urban spaces can improve accessibility, encourage diversity, and support economic development (Mehta, 2007).

Urban form, most directly accessways, dictates people's movement within a city. People's inclination to walk based on the neighbourhood's perceived safety, suitability and pleasantness can be defined as "walkability" (Suarez – Balcaza et al., 2020). Individuals' desire to walk and the regularity with which they walk for leisure are influenced by the built environment. Literature suggests people are less likely to walk on poorly maintained, visually unattractive, or desolate sidewalks as they can be associated with low safety (Suarez – Balcaza et al., 2020; Jacobs, 1961). Low walkability discourages residents from accessing public transport or utilising active transport methods (Veerman et al., 2016). Prioritising one mode of transport in urban planning will directly influence public motility. Urban forms designed to support private vehicle use can discourage active transport, while urban forms designed to support pedestrians can equally discourage vehicle use. Mobility is most successful and sustainable in high-density urban areas when active transport and shared transport are fully utilised (Pucher & Lefevre, 1996).

Mixed-use spaces define an urban form that blends different uses, such as commercial, residential and entertainment (Mizaei et al., 2016). Mixed-use space aims to create urban areas that promote economic, social, environmental and physical development (Mizaei et al., 2016). Many studies have investigated the benefits of mixed-use space. Some benefits include; ecological restoration, diverse and inclusive housing options, increased accessibility, and an improved sense of place and community (Un., 2010). In addition, mixed-use spaces can enhance vitality by supporting active engagement with the street and establishments at various times throughout the day and night (Jacobs, 1961). This vitality is also a critical supporting feature to sidewalk safety with the 'eyes on streets' model suggested by Jacobs in The death and lie of great American cities, 1961. From a sustainability perspective, mixed-use space minimises car use due to proximity and precludes urban sprawl. Further, high concentration and diversity of activities within an area boost vitality, attractiveness, and living quality.

Mobility, Motility, and Amenities

Mobility is "the ability of individuals (or goods) to move around freely" (Rodrigue, 2020). Mobility is something that someone 'has' as if it is a tangible object. Mobility has evolved throughout time, significantly as modes of transport have changed. Motility is a concept that exists within mobility. It can be defined as 'potential mobility' (Cuignet et al., 2020) or 'capacity to use transport modes' (Rodrigue, 2020). External factors often influence one's motility. If insufficient infrastructure allows one to access facilities, their motility will be impacted. Both mobility and motility play a role in an individual's ability to access amenities. Amenities must be located throughout a community in ways that all citizens can access.

Personal movement is classified by Rodrigue (2020) as being a voluntary movement. It can include movement to recreational and commercial activities, supporting individual wellbeing. Motility is highly linked with personal movement. The wellbeing of older adults is often increased when they can engage in personal movement, and transport systems need to be in place to enable this (Cuignet, 2020). Amenities need to be located within a reasonable distance of residential areas in order for communities to utilise them.

Touristic movement is an alternative urban mobility type. Some locations of interest will have historical importance, while others will be attractive due to the recreational activities (Rodrigue, 2020). Representations of locations in media and film highly contribute to a city's tourism mobility. Individuals may avoid or seek out locations depending on how they are portrayed. Whether these representations are accurate will alter tourism mobility (Diekmann & Hannam, 2012). International sporting events are also vital in touristic movements (Rodrigue, 2020). Amenities, therefore, need to be placed near facilitators of said events. Tourists can be hypercritical of host countries, especially concerning the functionality and visual aesthetics. This highlights the importance of aspects such as micro-greenspace.

As the name suggests, professional movements are directly related to an individual's profession. Typically, they occur during regular work hours (Rodrigue, 2020), and some of these movements can be classified as pendulum movements due to their cyclical nature. However, when examining the professional movements of a population, they are not as

cyclical as they may appear to be at face value. Everyone experiences a different 'normal' in terms of their work hours. For example, those who engage in infrastructure development or maintenance will likely experience professional mobility far outside of the '9-5' experienced by most of the population. In addition, children are required to attend school simultaneously every day, mimicking the movements made by adults. Müller et al. (2021) have highlighted the failings of urban development in the study area, creating unnecessary difficulties for children, particularly those in peripheral urban areas.

Encouraging Investment

Encouraging investment within an area is complex. Government policies and community attitudes can significantly influence investment types and successes within a given area. Economic status is strongly linked to several societal issues, and those of a lower class are disproportionately impacted in the case of a stressor (Thiede & Brown, 2013). Literature suggests that improving community resilience can include an 8 80 city concept that could be integrated. The cities involved in the 8 80 organisation believe that the public spaces within a city should be accessible and usable by those of all ages, between 8 and 80 years old (8 80 Cities, n.d.). To be a plausible scenario, both housing and amenities need to be diverse. Investors should be encouraged to diversify within a community to increase the population demographic they are catering to.

High-density housing can support diverse population demographics within a community, aligning with the fundamental concepts of an 880 city (880 cities n.d.; Jacobs, 1961). This housing type appeals to investors as the high financial return ratio on housing units to land areas is high. High-density housing can be affordable and support socioeconomic diversity, with the Kainga Ora development providing an excellent example in Auckland (Kainga Ora, 2022). Thirty success factors were ranked internationally, with the top factor being 'political will and commitment to affordable housing', highlighting the importance of both public and private interest (Adabre & Chan, 2019). The report also highlighted the importance of 'adequate accessibility to social amenities' (Adabre & Chan, 2019). Investors cannot solely focus on creating affordable housing or a range of housing types, and there must also be additional facilities and amenities nearby. Having diverse amenities increases the likelihood of success of high-density housing, a concept that should be encouraged to reduce urban sprawl (Rappaport, 2008).

The concepts explored by Adabre & Chan (2019) and Rappaport (2008) highlight that high-density housing increases investment in amenities and vice versa. High-density housing often attracts young working professionals and families. If businesses and other investments are located in or near high-density residential areas, accessibility becomes high, supporting customer engagement (Ahlfeldt & Pietrostefani, 2019). Accessibility is a vital determinant of both housing and business location and highlights the issue of access and space (Kane et al., 2017). A study of changing urban dynamics in Long Beach, California, by Kane et al. (2017) identifies that the shift to high-density housing is altering the economic status of the surrounding areas. Those of an older demographic are more likely to shift away from a central city and typically desire more land. In contrast, those younger demographics will be attracted to high-density housing, predominantly due to nearby amenities (Kane et al., 2017).

Results

Mapping

Public access routes were mapped in *Figures 4a and 4b* to better understand the community and social movements through the study area around Te Kaha. Ensuring these routes are adequately serviced, and desirable to the community is vital to encouraging active transport and sustainable development. The eastern edge of the study area has significantly less developed cycle infrastructure, while the bus network is well distributed.

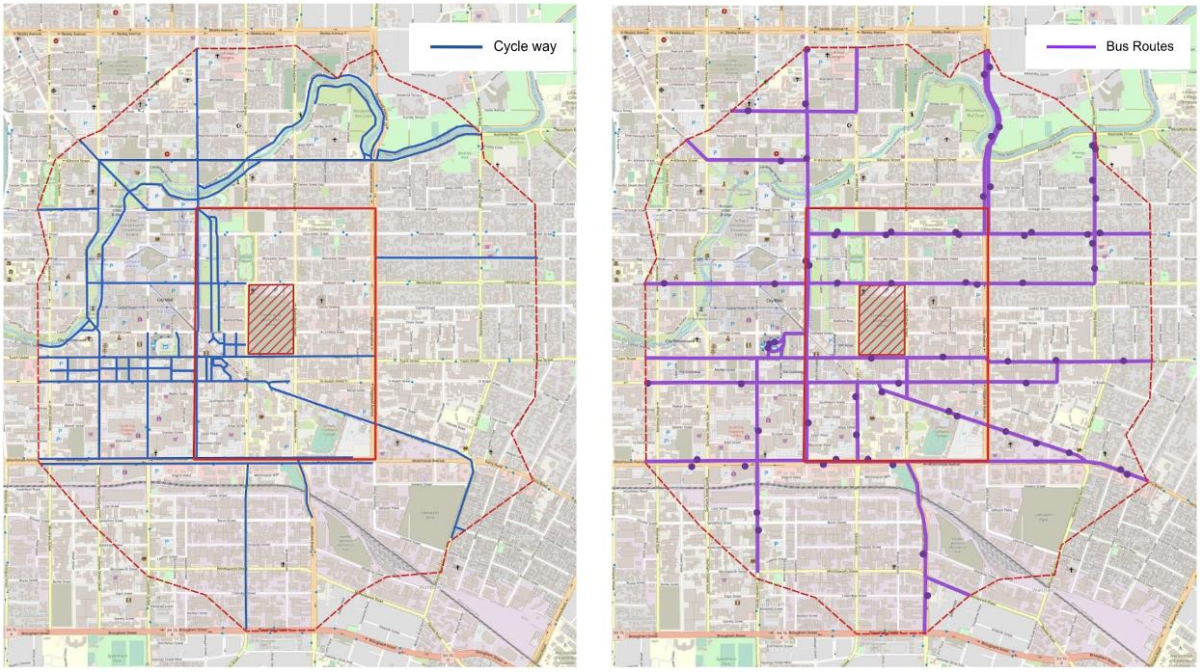

Figure 4a: (left). The current cycle infrastructure network. Figure 4b: (right). The current bus routes and bus stops.

Greenspace within the ten-minute walking boundary has been mapped in *Figure 5*. The majority of the green infrastructure follows the Otakaro/Avon River corridor in the northwest quadrant. Red zone land was not included as green infrastructure because of its lack of service. Within the study area, Latimer Square provides the most significant accessible greenspace, alongside the green belt Rauora Park. There are small pockets of plantings and grassed spaces around Ara Institute of Technology in the southern reaches. The upper east quadrant is primarily residential housing serviced by one neighbourhood park in the northeast but is also within walking distance of the river corridor and Beverley Park. The eastern middle section of the study area has the lowest access to greenspace, currently mainly being light industrial buildings.

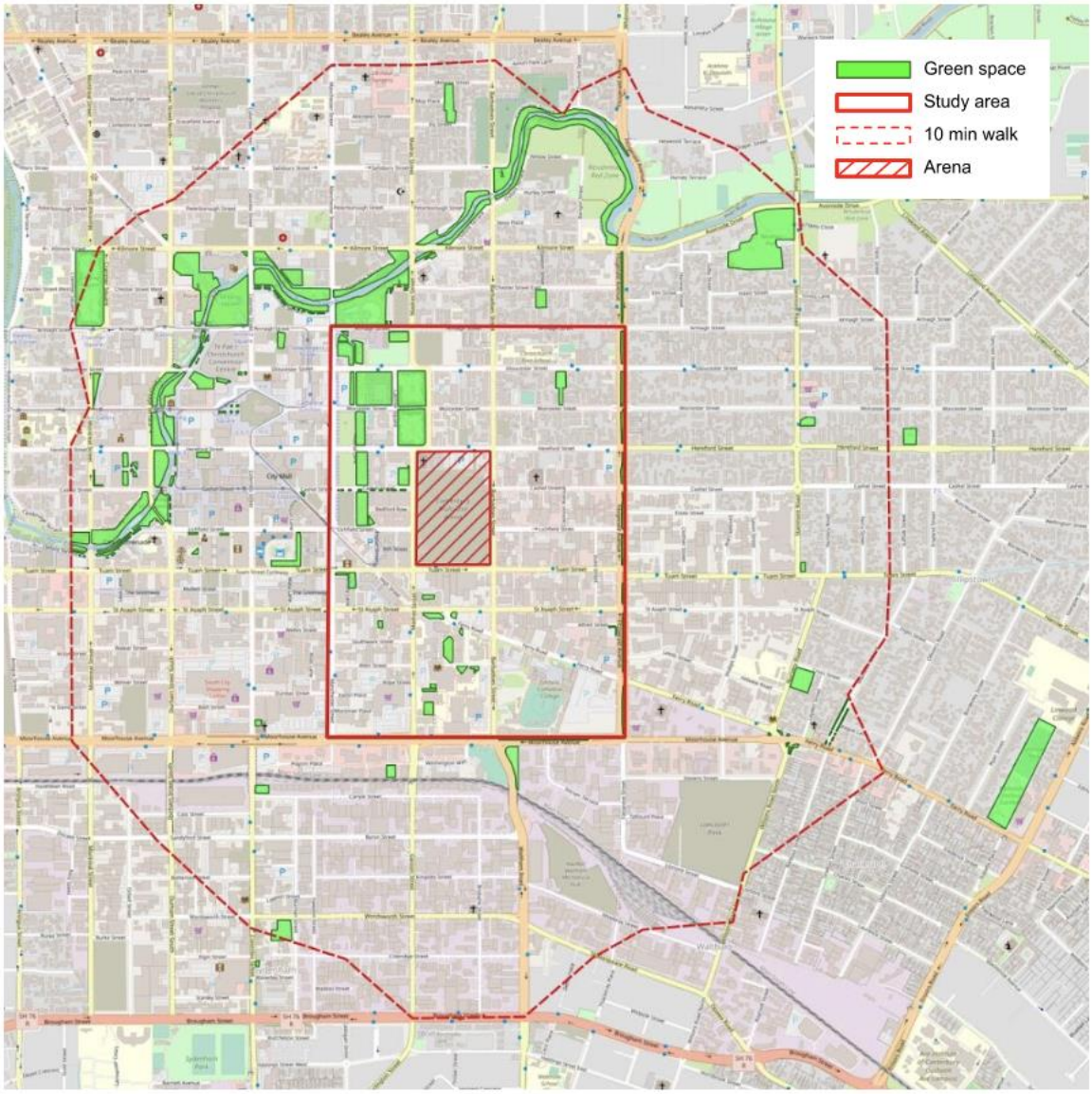

Figure 5: Publicly accessible permanent greenspace in and around the study area.

To further support the spread of greenspace, *Figure 6* shows band altered satellite imagery highlighting the vegetation cover in the study suburbs. Dark green indicates vegetation cover, including grass, bushes, and tree canopy cover, while bright white indicates impermeable surfaces like roofs and pavement.

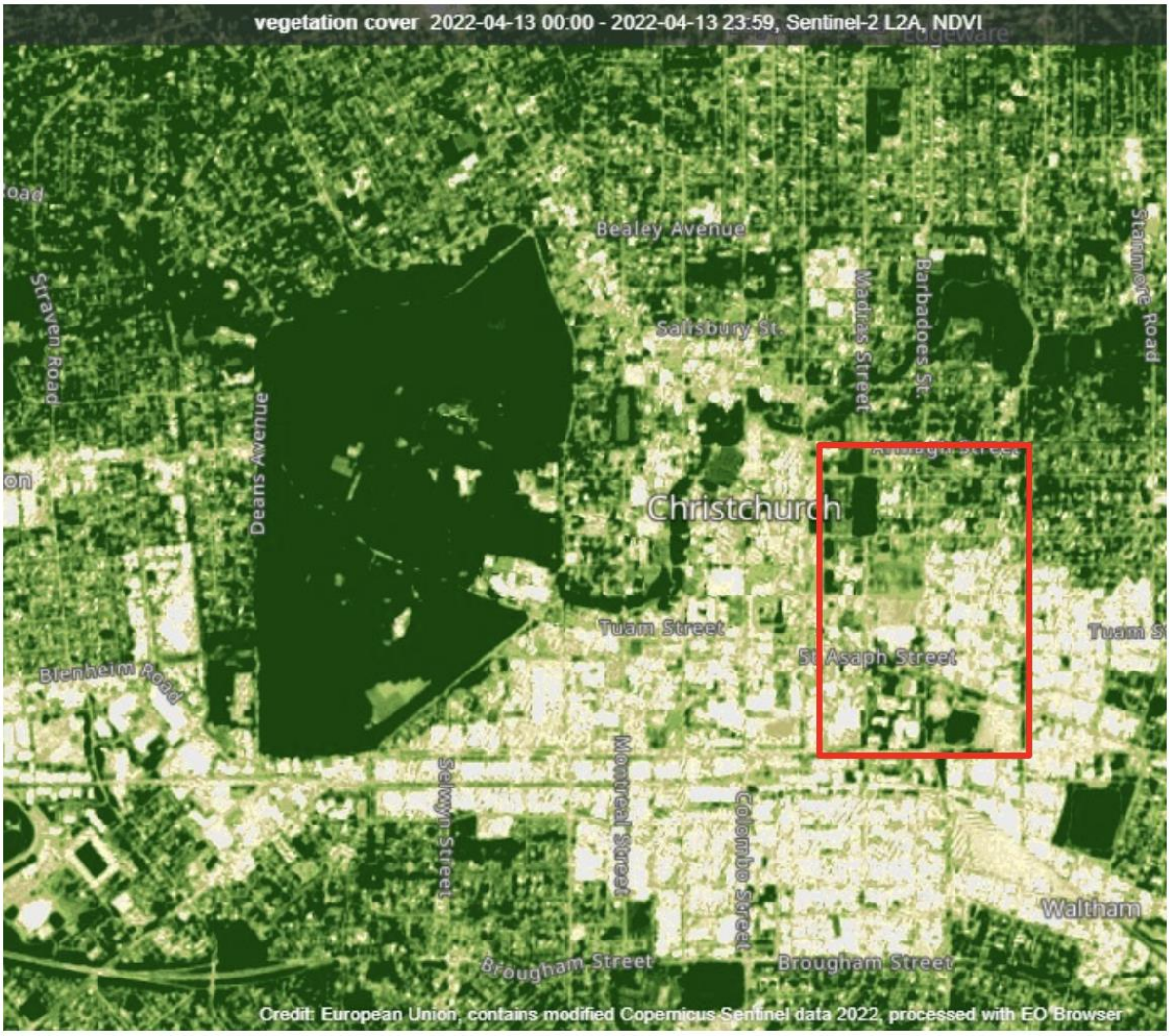

Figure 6: Vegetation cover from 2022 Sentinel 2 L2A satellite imagery over Otautahi Christchurch with the study area in the red boundary.

Figure 7 shows the locations of amenities and services within the ten-minute boundary. The central west area shows high amenity density due to the Christchurch CBD. South of the research area has limited access to residential serving amenities due to primarily industrial land use. There are multiple food amenities in the central east of the study area.

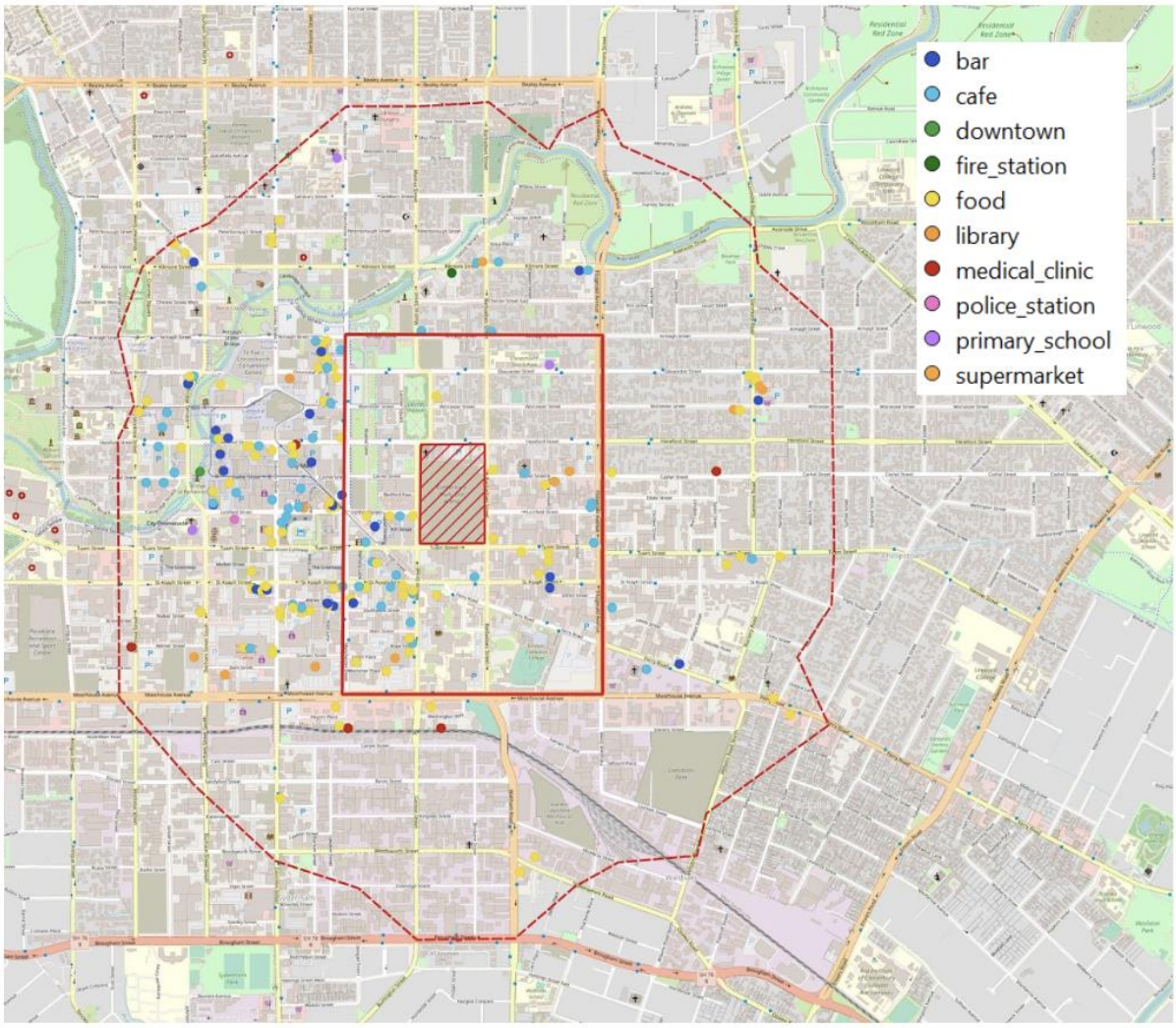

Figure 7: Locations of different amenity types in the study area and wider catchment.

Primary Observations

Greenspace was explored on foot around Latimer Square and the Otakaro river corridor. Pictures were taken to be discussed as a team and help understand the physical characteristics that support greenspace utilisation. *Figure 8* shows the largest greenspace in the study area, Latimer Square. These observations validated the greenspace mapped through open-source data. It was found that all major greenspaces were captured through open-source data. Drive-by observations found a few missing micro-greenspaces, particularly around Ara and the research area's southern end, which were subsequently added to the map.

Figure 8: Latimer Square.

Food amenities were observed on foot in high-density areas, such as St Asaph Street, Stanmore Road, and Tuam Street. Locations from open-source data were verified. Some were altered slightly to better reflect their uses, such as changing locations from a 'bar' to a 'food' establishment. There was a wide variety of food amenities, from high-end restaurants around the river to local takeaway shops in the more industrialised areas. Bars were commonly grouped and had other bars and drinking establishments nearby. Bars and dine in restaurants are vibrant during afternoon and evening hours, especially in the central business district along the river. In contrast, cafes were the most lively in the morning until around lunchtime. Workers, presumably from the surrounding industrial area, visited the cafes on Fitzgerald Avenue at the observation times, just before noon. It was noted that

> "Food and drink amenities in the CBD had higher aesthetic amenity and seemed to attract people from outside the area to visit them, while food establishments in the industrial and less frequented areas seemed to cater to locals".

A mixture of food amenities in high-density areas attracted a wide variety of patrons; this was especially obvious in locations such as Little High, which provides multiple cuisines and experiences within a small area. One of the grocery stores within the study area caters specifically to oriental cuisine and therefore attracts similar demographics of people.

Street aesthetics were starkly different in the industrial area compared to the CBD. The CBD presents a people-focused landscape, with wide footpaths, street plantings, cycleways, narrow roads, lots of artwork and places to sit or mingle. In contrast, the light industrial area presents a focused vehicle landscape, with wide roads, baron asphalt footpaths, no vegetation and no cycleways. *Figure 9* shows the light industrial area topology. There was significantly higher pedestrian traffic in the CBD area than in the light industrial area, with some pedestrian traffic being observed in the residential area to the northeast.

Figure 9: Typical Street landscape in the light industrial area, South East in the research area.

Discussion

Greenspace across the study boundary is illustrated through *Figures 5*, and *6*. These images show clear trends in greenspace distribution. The residential suburbs in north Latimer have far more vegetation cover than the industrial areas. The satellite vegetation cover image provides an exciting delineation between historical land use zones. Residential zones are 'more green' due to a higher impermeable to permeable surface ratio due to residential gardens and lawns. In contrast, large building footprints and more significant areas of pavement infrastructure around commercial and industrial areas show bright white in the image. Increased tree canopy cover and micro greenspace along transport ways in residential areas increase the aesthetic value, supporting suburb permeability (Roberts et al., 2017). This encourages more individuals to move through the suburb freely, without going around it or avoiding it. Active and public transport usage are preferable, as they best engage with tree canopy cover and support the sustainable development goals outlined in the CCC Climate Change Strategy (CCS) (Peters et al. n.d.; CCC, 2021). Individuals who primarily use private transport are likely to miss improvements and beautification of streets. Temporary pocket greenspace would be an easy and economical way to increase green infrastructure and vegetation cover in the industrial areas (Seymour, 1969).

Mixed-use spaces, not strictly residential, provide substantial co-benefits for urban design and sustainability by supporting suburb permeability and vitality. There is less need to travel to essential access amenities due to their close geographical proximity, leading to more movement within the community. As well reduced commuting and travel reduces car associated carbon emissions and supports the CCC CCS. Mixed use space also increases the vibrancy of the street due to increased foot traffic and space utilisation and a range of times (Mahta, 2007; Jacobs, 1961).

Several amenities in Latimer and South East neighbourhoods, such as bars, restaurants, and libraries, can enrich a community (Dayal et al., 2012). Different amenities will appeal to various population demographics, suiting their social needs by encouraging engagement within their community. These are in addition to essential amenities, many of which became apparent during the COVID-19 nationwide lockdowns, examples are supermarkets, pharmacies, emergency services, and medical clinics (New Zealand Government, 2022). When directed to *Figure 7*, it can be seen that predominantly 'wanted' amenities are located within the study area, and required ones are located outside, to the west. There is an overall lack of amenities in the areas directly north and south of the proposed Te Kaha.

Personal mobility, especially east/west movement, could be negatively impacted by the construction of Te Kaha. People may choose to avoid this area and use alternative amenities in surrounding areas to avoid traffic or civil works. However, those that engage with professional mobility will likely continue to move past Te Kaha during construction as it will be the most direct route to their workplace (Rodrigue, 2020). The light industrial southeast will likely see residential development. Residential areas benefit from 'wanted' amenities, increasing community interactions and stimulating vibrancy by encouraging local activity.

Accessibility is an issue that is highlighted in *Figures 4a* and *4b*. There are significantly more cycleways to the western edge than in the study area. This limits the ability of residents to cycle safely to amenities. If the CCC aims to encourage residential development in this area, active transport infrastructure development must complement this. Evidence shows that if people feel unsafe or there is no existing cycle infrastructure to provide security they are less likely to use active transport (Winters et al., 2018). There is a lack of cycle infrastructure connecting the CBD to the southern suburbs of Christchurch. Outdated single-use land zoning policies have created a light industrial area that divides the residential and commercial parts of the city. Industrial zone accessways are not designed to accommodate active transport therefore the streets intersecting and connecting the current residential neighbourhoods and the CBD discourage suburban permeability.

Figure 4b depicts the bus routes through the suburbs. Many bus routes run parallel, east to west, through the Latimer and South East areas. There is good bus accessibility throughout the study area, and routes converge at the nearby bus interchange to allow access to other suburbs. The bus network will increase the motility of residents, as they can be easily connected to other parts of Christchurch. There is a considerable correlation between cycle infrastructure, bus routes, and amenities located outside the study area. This means that despite a lack of essential services in the Latimer and South East areas, those with motility that allows them to utilise this infrastructure will not be disadvantaged.

The transport system through the relatively small study area provides an opportunity to increase business investment in this area. Business investment will likely occur with plans for high-density housing within the Latimer and South East. The tertiary education present in the study area, such as Ara Institute of Canterbury and NASDA, gives students the opportunity for high density, affordable housing. This population demographic is most likely to engage with transport systems such as cycling and busing and engage with amenities most related to wellbeing. Bars and cafes within the suburbs will thrive with this population demographic.

Te Kaha will be built in the centre of the study area. When hosting significant scale events, tourists and residents will be attracted to the area. The entertainment and hospitality amenities will likely boost attraction during these times, which will benefit the local economy. There is land available in the lightly industrial area of South East that has the potential to be reallocated towards entertainment and hosting amenities. The businesses in this area may experience peaks in economic activity, which will be heavily dependent on the usage of Te Kaha at times throughout the year.

Limitations

Lack of amenity literature specific to Otautahi Christchurch

While the need for some specific amenities will be universal, population demographics and the general social environment will dictate what is required within a given community. Currently, there is a lack of amenity research specific to Christchurch, so case studies from other similar communities were applied to the study site. Christchurch is unique following the 2010/2011 earthquake sequence because the CBD has not served its traditional purpose. Many businesses were pushed out into peripheral suburbs, and new industrial hubs were created. It has been challenging to draw businesses and families back into the traditional CBD near the study site for more than a decade. Other case studies have not faced this dilemma, making the required amenities different from other communities. The lack of Christchurch specific literature proved to be a limitation when deciding which amenities needed priority development.

No community input

This research has not included elements of active collaboration with current residents that reside within the central Christchurch suburbs of Latimer and South East. One example of active collaboration with residents is sending out a survey to the residents that reside within the area. A collaborative approach with researchers and residents is data crucial to this research because it will provide helpful information on what amenities the residents want as a priority development concerning our research question. For example, if survey data on residents were obtained, this might have supported our discussion on where the development of blue greenspaces and amenities can be implemented. Another limitation of this research is that no data suggests that local businesses are willing to start in or around Te Kaha.

Technical limitations

It was assumed that information on the CCC website regarding transportation infrastructure was up to date. However, there is a chance it could be outdated given the abundance of civil works currently underway in the CBD. In addition, the transportation infrastructure data was replicated from the CCC website manually. Although this was peer-reviewed, there is the possibility of human error, leading to unforeseen missing or excess information.

Not all amenity locations could be verified through observational data. Therefore there is uncertainty related to locations solely reliant on OSM and Google Maps. In addition, establishments may have changed, either closed down, moved, or changed ownership, which may not have been updated on the mapping services before this research was conducted. Therefore the point locations and their specific services should only be used to guide the general trend of amenities available in the surrounding area.

Recommendations for the Christchurch City Council

Based on the research findings, three significant and supporting recommendations provide a wide range of benefits for future development. The three significant recommendations are; the location of streets that would benefit from micro greenspace and footpath development, the optimum area for a neighbourhood ‘pocket’ part, and an extension of the current cycle network. These recommendations follow the key findings of the geospatial

mapping and integrate benefits explored through the urban form and mobility literature review. All recommendations act as a starting point for future development exploration at the CCC and hope to narrow the scope of planning investigations. However, it is also noted that this puts forward a purely academic perspective and does not consider each recommendation's economic or project planning feasibility.

The first recommendation guides the optimum location of future green/bluespace. To provide the most significant community benefit, this report suggests the area outlined in *Figure 10* is the best location to consider buying land for development into a small park or green thoroughfare between blocks. The outlined area currently has the lowest accessibility to greenspace within the research bounds. Further, the area hosts three cafes and two food amenities, providing complimentary amenities essential to ensure diverse use of the space. The current infrastructure within the area is light industrial and commercial. Therefore it is assumed the financial value of the land will only increase as time passes and surrounding development is undertaken. Providing a green space in this location would ideally offset future high density housing in this area and provide a natural break in urban infrastructure. The development should consider co-benefits and natural design principles such as rain gardens or green stormwater opportunities. If a greenspace is to be developed within this area, the space must be designed for the local community with community engagement and co-design.

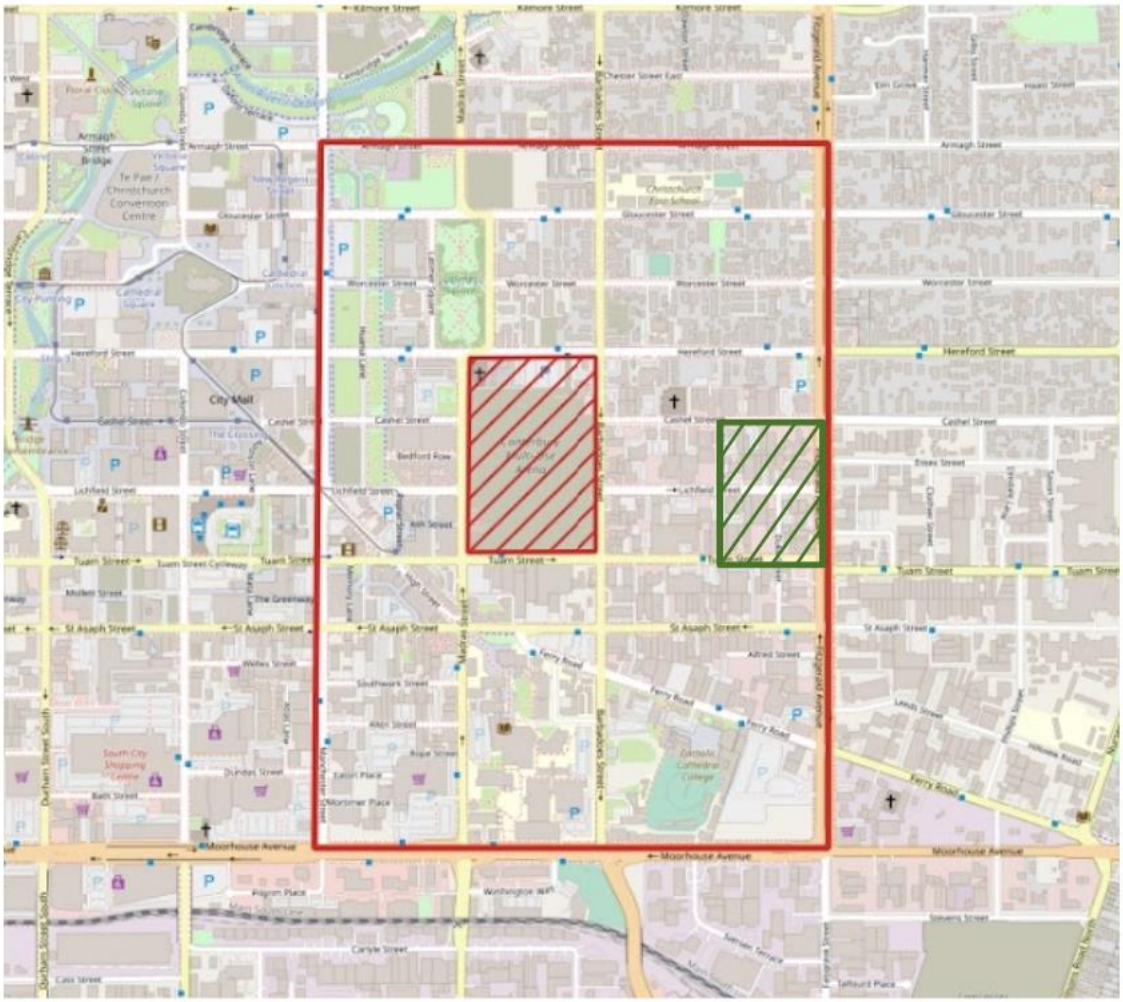

Figure 10: Optimum location to develop green/blue infrastructure, shown in the green hatch, serves the surrounding neighbourhoods and the research area.

The following recommendation is to invest in micro-greenspace and street beautification. Although space for a park has been identified in the previous recommendation, the preferred green space recommendation is micro-greenspace development. In line with the suggested street upgrades accompanying the build of Te Kaha, this report has identified streets that will be important for public mobility. The streets outlined in *Figure 11* currently lack aesthetic value, green/blue amenities, and social vibrancy, which are all crucial factors in active transport use. It is suggested that the council consider improving these streets' walkability to encourage access to the CBD by active transport modes from the eastern and southern residential neighbourhoods. Including micro greenspace provides multiple co-benefits with an illustrative example including temporary above-ground planter boxes; these can provide a safety barrier between cars and pedestrians, increased vegetation cover to provide urban biodiversity and temperature regulation, and increased aesthetic value of the street. Temporary planter boxes provide an economically attainable and time efficient alternative to complete street renovations by not needing civil works or disrupting local movements and traffic during construction.

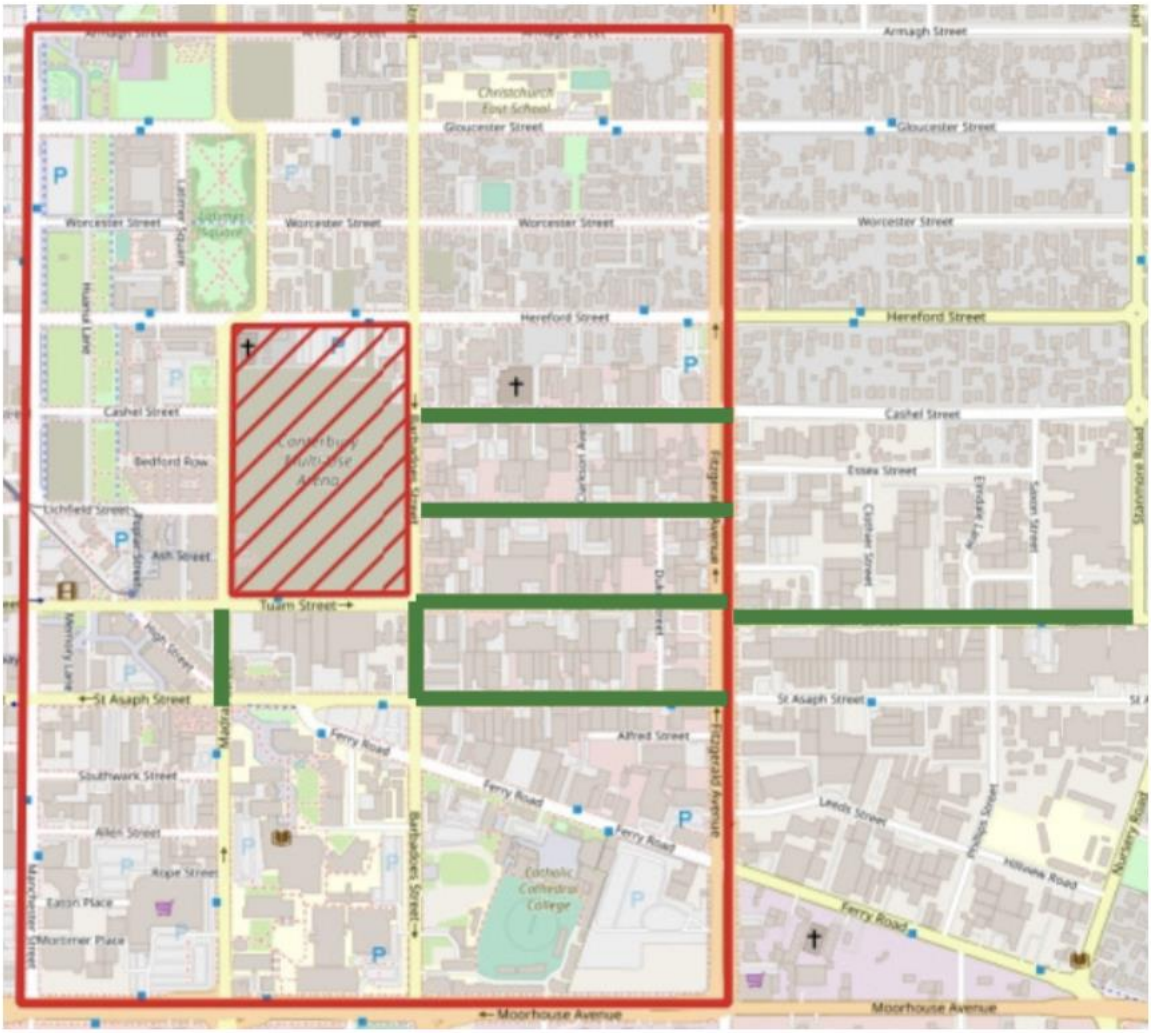

Figure 11: Streets in need of micro-greenspace development and beautification.

The third primary recommendation is to extend the current cycle network down Madras Street to connect Tuam Street and Moorhouse Avenue, as shown in *Figure 12.* This recommendation is straightforward and aims to support safe active transport modes between the southern residential suburbs and the development zone around Te Kaha. The

build of Te Kaha will likely stimulate economic investment immediately around the site, incentivising more significant movements of people to and from the area. To ensure Christchurch continues to develop in sustainable ways, active modes of transport must be considered supplementary to projects that work to draw more people into the city centre. The cycle lane extension aligns with the street upgrades already within Council consideration.

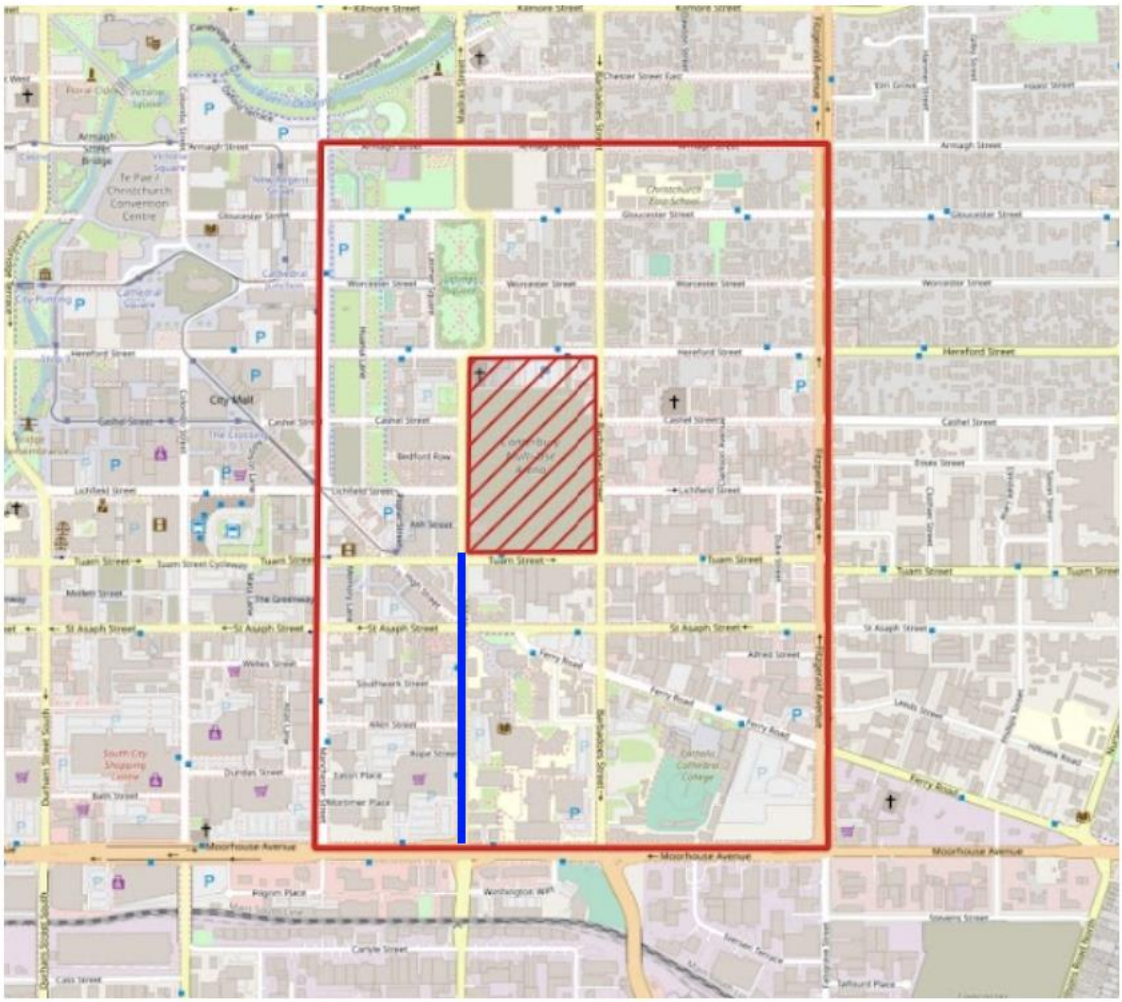

Figure 12: Cycle lane extension is shown in blue along Madras Street to encourage active transport from the southern suburbs.

Conclusion

Christchurch is currently looking at ways to revive and densify its city centre following the earthquake of 2010/11. These significant events saw a drop in resident population and highlighted how a lack of urban resilience impacts a city centre. Te Kaha is being built in the Latimer South East neighbourhoods of Christchurch's CBD. This research provided the neighbourhoods with recommendations on what amenities should be developed around Te Kaha to support intensification. The literature review suggests that effective utilisation of blue-green infrastructure, urban form and accessibility, mobility, motility and amenities, and encouraging investment are key themes to consider when developing amenities around the arena.

Currently, the space around the arena is a mixture of industrial and residential suburbs with many amenities, such as large parks and eateries. This research provided recommendations on what amenities need priority development in these areas to increase liveability. Results from the research provide the CCC with three recommendations that will improve the resilience and appeal of the space around the area. These recommendations guide the optimum location of future blue-greenspace, investing in micro-greenspace and street beautification in the light industrial areas, and extending the current cycle network down Madras Street. These suggestions serve as a beginning point for the CCC's future development study to narrow the scope of the planning investigation.

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