Health Impact Assessment of the Green Square Draft Infrastructure Strategy and Plan

April 2018

NSW GOVERNMENT Health
Sydney Local Health District

UNSW SYDNEY

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ABBREVIATIONS

ABS	Australian Bureau of Statistics
CBD	Central Business District
CPHCE	Centre for Primary Health Care and Equity
CHETRE	Centre for Health Equity Training, Research and Evaluation
CNOS	Canadian National Occupancy Standard
CPHCE	Centre for Primary Health Care and Equity
GP	General Practitioner
GSURA	Green Square Urban Renewal Area
HERDU	Health Equity Research and Development Unit
HIA	Health Impact Assessment
MCH	Maternal and Child Health
NSW	New South Wales
SLHD	Sydney Local Health District
TfNSW	Transport for New South Wales
TMAP	Transport Management And accessibility Plan (TMAP)
UNSW	University of New South Wales
WHO	World Health Organization

GLOSSARY

EQUITY

A health inequity may be defined as the 'systematic differences in health status between different socioeconomic groups'[1] where those differences are socially produced, systemic, avoidable and unfair.[2] Health inequity is concerned with health status, not simply the use of services, and with health differences that are considered to be unfair or unjust. It is about the pursuit of social justice and a belief that differences in health are socially created and therefore amenable to change, because many of the determinants of health are socially created and distributed and are therefore possible to change.[3]

HEALTH AND URBAN DEVELOPMENT

According to the World Health Organization (WHO) health is defined as: "a state of complete physical, mental and social wellbeing, and not merely the absence of disease or infirmity, is a fundamental human right and that the attainment of the highest possible level of health is a most important world-wide social goal whose realization requires the action of many other social and economic sectors in addition to the health sector".[4] Health of both communities and the individual is affected by the built environment.[5-7] Transport planning, land use, the provision of infrastructure, availability and design of public spaces have an impact on health and well-being.[6]

OVERCROWDING

While there is no universal agreed definition for overcrowding this report used the Australian Bureau of Statistics (ABS) which accounts for the number of bedrooms in the dwellings and the reported relationships between those occupying the rooms.[8] This definition is based on the Canadian National Occupancy Standard (CNOS). The CNOS assesses the bedroom requirements of a household based on the following criteria:

- There should be no more than 2 persons per bedroom;
- Children less than 5 years of age of different sexes may reasonably share a bedroom;
- Children 5 years of age or older of opposite sex should have separate bedrooms;
- Children less than 18 years of age and of the same sex may reasonably share a bedroom; and
- Single household members 18 years or older should have a separate bedroom, as should parents or couples.

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EXECUTIVE SUMMARY

Creating liveable and healthy communities within former industrial sites involves unique opportunities for developers and councils to imagine and create new communities through the provision of a high level of amenity and facilities, and connected active and public transport. However, delivering diversity, a sense of community and healthy environments for people across the life course in higher density environments is an emerging challenge. Therefore, a Health Impact Assessment (HIA) was conducted to identify the potential health impacts of the Green Square development. This report describes the HIA findings and its recommendations.

GREEN SQUARE URBAN RENEWAL AREA (GSURA)

The area is 278 hectares in size located in the southern part of the City of Sydney council boundaries, and includes the suburbs of Beaconsfield and Zetland and parts of Rosebery, Alexandria and Waterloo. The Town Centre is located four kilometres south of the Sydney CBD and will also be one of the densest areas in Australia, with 22,000 people per square kilometre. There are currently a total of 26,000 residents, projected to grow to 61,000 residents by 2036. The City of Sydney Council has planned approximately $540 million of high grade community facilities, including a district aquatic centre, library, playing fields, footpaths and cycling infrastructure (data provided by the City of Sydney).

HEALTH IMPACT ASSESSMENT (HIA)

This was a decision-support HIA (as opposed to mandated, community-led) on the Draft Infrastructure and Strategy Plan of the Green Square development. The aim of the HIA was to identify the health effects of the implementation of the Plan and associated initiatives, including potential positive, negative and unintended consequences on health; and to provide recommendations on how to mitigate these impacts. The focus was on four areas:
1) transport
2) housing affordability
3) child health and development and
4) social and community infrastructure.

FINDINGS

Housing

Three potential negative impacts include: housing stress, housing insecurity and risk of overcrowding. Most people (63%) currently living in Green Square are renters with the proportion of those living in group households increasing from 2011 to 2016 by 106.7%. Median rental price is also higher than the City of Sydney. Higher rent may result in less disposable income, hence people are then forced to make trade-offs among housing, food, medical care, and other basic needs. This increases the likelihood that people may postpone medical services for financial reasons. One potential negative impact of housing density is insufficient infrastructure to deal with emergencies. Emergencies may arise within buildings, within the centre or across the Green Square Renewal Area.

Transport

Access to transport is an important determinant of health. Developing a connected and well-functioning transport system within Green Square faces several challenges. Many of these challenges are common to “brown field” developments and include: poor linkages to long established arterial roads that limit pedestrian movements and amenity; increased congestion on arterial roads means that passing traffic may use local/ neighbourhood routes; and multiple government agencies having responsibility for developing a transport network. The City of Sydney has demonstrated best practice by promoting active transport by building cycle and walking tracks, and promoting these, and public transport (rail and bus) to reduce car use. However, despite the City’s best efforts to create a walkable environment, the Department of Transport is putting in a major road from Moore Park to Alexandria that will cut through Green Square, reducing pedestrian and cycling amenity and connectivity

Child development

Five key areas of healthy child development that may be impacted by urban development and density are: physical activity related to participation in active transport (walking and cycling), outdoor play and exploration, minimising exposure to traffic and air pollution and increasing access to high quality local schools.

Social infrastructure

Social infrastructure includes facilities, places, spaces, programs that support the quality of life in a community. It is seen as a way of encouraging social inclusion, supporting diverse and sustainable communities, increasing access to facilities and assisting economic development. The provision of social and community infrastructure – or the lack of an adequate infrastructure – can have major impacts on the physical and mental health of members of urban communities, and on the level of community cohesion. It is important to ensure that opportunities to build a strong and healthy Green Square community are maximised.

RECOMMENDATIONS AND CONSIDERATIONS

Priority issues that require immediate action include:

Secure housing tenure

At present most people in Green Square are renters with a substantial number of people living in group houses. The term secure tenure refers to both the length of renting tenure and the conditions include maintenance and upkeep. The imbalance in the supply and the demand for new housing can place renters at risk of accepting poor renting conditions. There is an assumption that current policies will fill the backlog in the supply of dwellings. Review of the demographic assumptions and policies are required as is and reform of the way the Residential Tenancies Act 2010 works. The City of Sydney has in place the following strategies to secure affordable housing for key workers. This includes, the City of Sydney policy plus 2030 target. The supporting the provision though subsidised land to key worker housing providers (City West Housing and St George). Agencies responsible: The State Government should set minimum target and requirement on new developments including own land.

Schools

Currently Alexandria Park Community School is the only mainstream primary school within a one-kilometre radius of the Green Square town centre, despite the 2016 census identifying over 2,000 children under 12 currently living in the area. The City of Sydney is now in discussions (11th December 2017) with the Department of Education on the provision of a 600 place primary school in the Green Square town centre of an integrated community facility and school project with the City of Sydney. Agencies responsible include: Department of Education, advocacy by the City of Sydney and Civil Society Organisations.

Transport

Central to the healthy urban development is active transport that promotes walking, cycling and the use of public transport to reduce car use. The City of Sydney should advocate for each of the 8 factors critical to the implementation (see Appendix 1), to be urgently reviewed and revised. Agency responsible: City of Sydney (for advocacy) and the State (provision of adequate public transport).

Permeability/connectivity

Mitigation strategies should be developed to reduce the impact of the Alexandria to Moore Park road upgrade on permeability and connectivity. Agency responsible: City of Sydney and Transport for NSW.

Emergency preparedness

Green Square does not have a comprehensive and tested emergency preparedness plan to deal with fire, explosions or other emergencies that require ease of access and egress for first responders. A comprehensive disaster management and preparedness plan should be developed and routinely tested. The plan needs to be integrated with the State disaster plan, and developed according to international standards. Agencies responsible include: the State and the City of Sydney.

Further recommendations are:

Healthy internal environments for children

Internal environments may limit opportunities for child development. In order to support healthy internal environments for children there is a need to review building size, wall thickness and storage spaces; have building codes that support child development; consider indoor playing areas or similar areas and involve children in the design process. Agencies responsible for ensuring healthy internal environments for children include: Department of Planning lead agency and partners include SLHD, Government Architects Office and the City of Sydney.

Mitigating the effects of climate change

It is possible to mitigate the effects of climate change through appropriate design. There is a need to build in ways that minimises the effects of weather extremes and reduce greenhouse emissions. By increasing open space and supporting the development of a green forest and an urban corridor. As well as aim to have zero emissions for new buildings. Agencies responsible: City of Sydney and Department of Planning.

Preserving pockets of land

There is a lack of space for future developments such as schools, and health services, community owned and developed facilities such as places of worship, club housing and possible co-working office spaces. Central spaces might not meet the granular issues around the neighbourhood. Identify pockets of land for potential affordable spaces that enable community-led social groups. Lead agency is City of Sydney and partners include other government agencies who own land in Green Square.

Living on a building site

Many residents will be living on an active building site for many years. Guidance should be developed on ways in which these potential negative impacts can be mitigated. Sydney Local Health District (SLHD) should include this in the “Building Better Health guidelines”. The City of Sydney is leading the way for Green Square on the construction liaison position. Agencies responsible include: SLHD with NSW Health.

Technological development

Technological development can be anticipated to have implications for development and design. A process should be established to “future proof” Green Square. Agency responsible: City of Sydney.

Planning across the life course

The population will change and age over time. Infrastructure planning needs to consider how this may impact on transport and social and community infrastructure. A process for quarantining of land for aged care facilities should be developed. Habitat III is the international benchmark that should be pursued. Places should be allowed to be modified to suit the needs of older residents. For example, reinforce the bathrooms and stairwells so that modifications become possible. Agency responsible: Commonwealth and State Governments.

1

INTRODUCTION

This document is the final report of a Health Impact Assessment (HIA) conducted on the Draft Infrastructure and Strategy Plan of the Green Square development. The report is organised into five sections. Section one describes the Green Square Urban Renewal Area (GSURA) and the population demographics. Section two outlines the aims of the HIA and the governance arrangements. Section three describes the method of the HIA. Section four focuses on the findings and the discussion of the potential health impacts of the HIA and potential mitigating strategies. The final section presents the HIA recommendations.

The GSURA project has an estimated total development value of $13 billion and a projected new population of 61,000 residents by 2036 and 21,000 jobs.9 This makes it one of Australia's largest brownfield development sites and urban renewal projects. The project is larger than all of the other State Significant sites in the City of Sydney combined, and it will be one of the densest areas in Australia, with 22,000 people per square kilometre. Public infrastructure will cover 51.4 hectares or about 18.5% of the land.

Its industrial past means that it is located on a major economic corridor in Sydney linking the Sydney Central Business District (CBD) with major transport infrastructure such as Sydney airport, Port Botany and major roads out of Sydney. However, as a brownfield redevelopment site there is limited infrastructure (such as sewage, trunk drainage, parks, community facilities and health services), which is now very old and not suited for the 20th or 21st century residential population.

The changing face of Sydney presents both opportunities and threats. For some people the redevelopment of Sydney presents a once in a lifetime opportunity to develop a thriving, liveable city that will promote health and well-being. The opportunities lie in its capacity to build one of the world's great cities. However the threats are that this new city will create pockets of social isolation and over time disadvantage. Planning for the next 50 to 100 years is an enormous challenge. Higher levels of urban density, big population growth over a short period of time and limited existing infrastructure are key challenges of this particular development.

The HIA of the Green Square Development aimed to:

1. Identify the potential (direct and in-direct) health effects of the Green Square development as outlined in the Draft Infrastructure Strategy and Plan.
2. Recommend strategies and actions to be taken to provide better health outcomes for residents of Green Square.
3. Strengthen the ways in which the Green Square development can promote health and reduce health inequities.

1.1 GREEN SQUARE URBAN RENEWAL AREA

The GSURA is 278 hectares in size located in the southern part of the City of Sydney council boundaries, and includes the suburbs of Beaconsfield and Zetland and parts of Rosebery, Alexandria and Waterloo (see Figure 1). It will eventually have 30,500 new dwellings; including about 10,000 now under assessment or construction (see Figure 2). It is predicted to provide 21,000 permanent jobs, many of which will be in the new town centre. The town centre will be built four kilometres south of the Sydney CBD next to the Green Square train station, bordered by Bourke Street to the north and Joynton Avenue to the east.

The City of Sydney Council has planned approximately $540 million of high grade community facilities including a district aquatic centre, library, parks, playing fields, footpaths and cycling infrastructure.

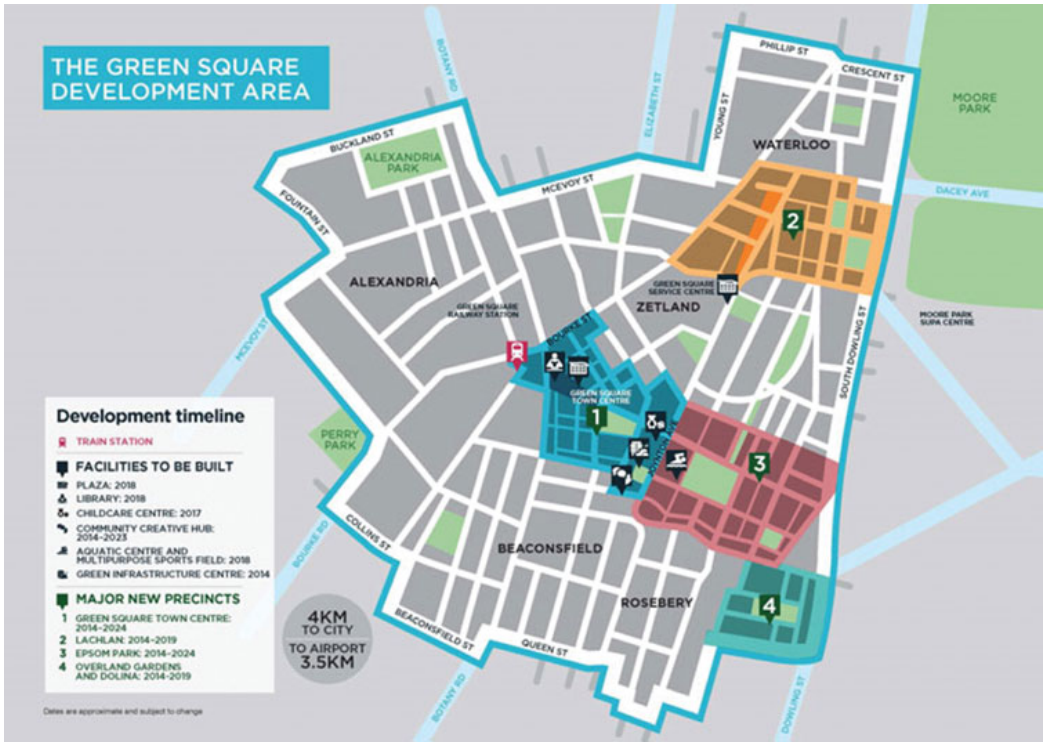
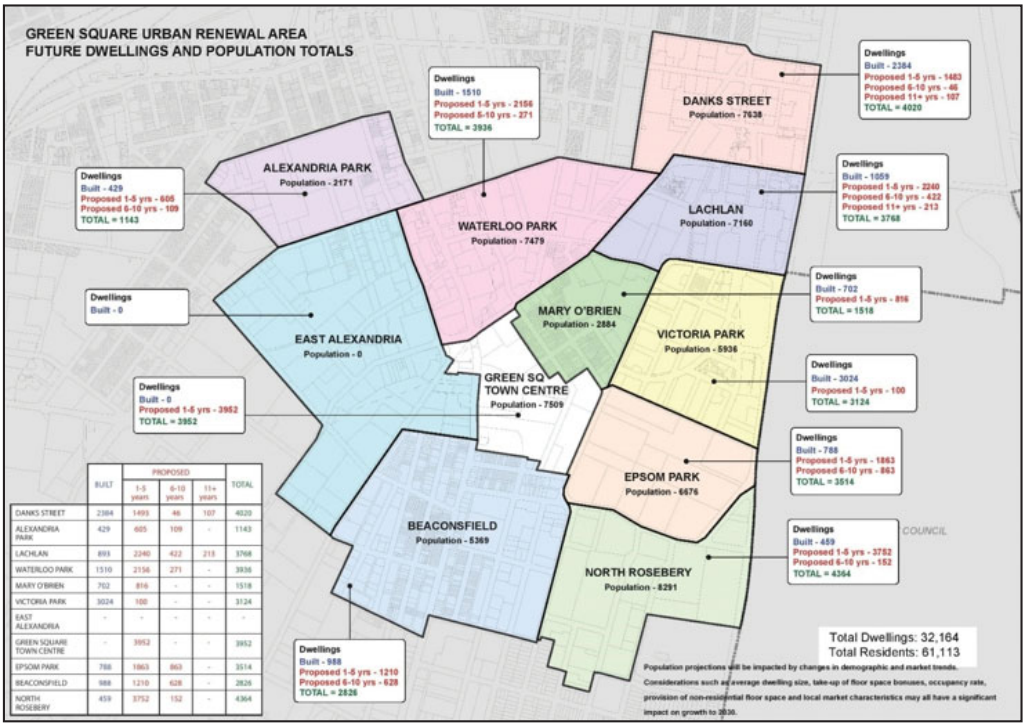


Figure 1. GSURA Location and facilities adapted from.[9] Note since the Plan was published the date have changed to 2020 for the Aquatic Centre and 2018 for the Green Square infrastructure centre.



	BUILT	PROPOSED 1-5 years	PROPOSED 6-10 years	PROPOSED 11+ years	TOTAL
DANKS STREET	2384	1493	46	107	4020
ALEXANDRIA PARK	429	605	109	-	1143
LACHLAN	893	2240	422	213	3768
WATERLOO PARK	1510	2156	271	-	3936
MARY O'BRIEN	702	816	-	-	1518
VICTORIA PARK	3024	100	-	-	3124
EAST ALEXANDRIA	-	-	-	-	-
GREEN SQUARE TOWN CENTRE	-	3952	-	-	3952
EPSOM PARK	788	1863	863	-	3514
BEACONSFIELD	988	1210	628	-	2826
NORTH ROSEBERY	459	3752	152	-	4364

Figure 2. GSURA total development capacity, dwellings and population by sections as of June 2016[9].

1.2 GREEN SQUARE DRAFT INFRASTRUCTURE STRATEGY AND PLAN

The Green Square Draft Infrastructure Strategy and Plan (the Plan) was developed by the City of Sydney council to identify both the social and the physical infrastructure necessary to support the growth of Green Square[9]. This HIA was conducted on the Plan. The Plan is organised in three parts. Part 1 provides an introduction to Green Square, its history, the vision, demographic characteristics and the strategic context.

Part 2 includes information about transport systems, streets, public domain, sustainability and social infrastructure. It examined what infrastructure has been provided to date, what is underway or programmed, and what will be required. Part 3 discusses governance/partnerships, stakeholder and community engagement and the implementation of the Plan, including an Implementation Action Plan.

The Plan seeks to ensure that the necessary social and physical infrastructure is clearly defined and understood so it can be in place as development occurs. This includes key infrastructure such as roads, trunk drainage and infrastructure such as schools, health services, parks, community facilities. Additionally, there is a focus on placemaking having the physical and social aspects of place creation organised. As well as, the delivery of community development initiatives, and social and cultural programs and services, and economic development initiatives to support the new development.

The Plan also seeks ongoing partnership with the agencies to ensure that the delivery of infrastructure is provided in an integrated, timely and efficient way. The Plan is reviewed and updated from time to time and described as a “living document” by the City of Sydney.

1.1.1 COMMUNITY PROFILE

According to the 2016 Census the total population in Green Square is 26,657 and this number is expected to grow to 61,000 residents by 2036.[9] However this forecast may vary with changes to the property market, the economy and other factors. The characteristics of the current residents of Green Square are provided in Table 1. Since 2011, the demographics of the population have changed, there has been a growth in group households (107%) which are typically student share, couples without children (83%) and couples with children (43%). Contrary to common perceptions that families move away from the city when they have children, the proportion of children aged 0-4 years old grew 56% from 2011 to 2016. The 2016 Census data also showed a growth in the proportion of young people aged 15-19 year olds (113%), 20-24 (112%) and 24-34 year olds (86%). This highlights the kinds of infrastructure required for these demographics; including community, health and education facilities.

Compared to the rest of the City of Sydney, Green Square differs in a number of areas: For example there are more people born overseas (62%) compared to the rest of the City of Sydney (55%) with a proportion of these born in China (24%). The majority of residents speak a language other than English at home (50% vs 41%).

Table 1 Population characteristics of Green Square residents

Characteristic*	Green Square (2016)	City of Sydney (2016)	Greater Sydney (2016)
Residents	26,657	224,211	4,823,991
Age groups			
0-4 years	4.7%	3.3%	6.4%
5-14	2.9%	3.4%	12.2%
15-19	6.0%	4.0%	6.0%
20-24	16.7%	13.7%	7.1%
25-34	39.4%	33.0%	16.0%
35-44	15.7%	16.3%	14.5%
45-54	7.3%	10.3%	13.0%
55-64	4.3%	7.7%	10.8%
65 +	3.0%	8.2%	13.9%
Country of birth			
Overseas born	61.7%	54.9%	36.7%
Three most common responses			
China	24.2%	11.2%	4.7%
United Kingdom	5.9%	6.1%	3.7%
New Zealand	2.7%	3.0%	1.8%
Language spoken at home			
Other than English	49.9%	41.3%	35.8%
Three most common responses			
Mandarin	22.9%	11.3%	4.7%
Cantonese	4.4%	3.3%	2.9%
Indonesian	2.3%	2.5%	0.6%
Education			
University	20.2%	16.1%	19.2%
TAFE	3.1%	3.1%	6.1%
Secondary	1.8%	2.0%	19.8%
Primary	2.1%	2.1%	25.6%
Pre-school	0.9%	0.8%	5.5%
Income			
Individual income	$1,035	$953	$719
Median weekly household income	$2,062	$1,916	$1,750
Family characteristics			
Couples with children	12.9%	10.3%	35.3%
Couple without children	35.3%	28.2%	22.4%
Sole parent + other family	6.2%	7.4%	11.7%
Group households	20.2%	14.2%	4.5%
Lone-person households	25.3%	39.9%	20.4%
Dwelling structure			
High density	89.9%	74.6%	23.5%
Car ownership			
Average number per household	0.95	0.75	1.7
With car	73.6%	41.3%	81.4%

**Category "not stated" was not included. The assumption was made that the composition mix of those who did not respond to a question is the same as those who actually. Data Sources: 10-12*

Potential differentials

At 23% Mandarin is the most common language spoken at home. The proportion of people who reported speaking another language and English not well or not at all was 6.6% (1,658 people). Therefore bilingual and translation services may be needed in the area, in order to support appropriate access to health care.

According to the population characteristics 13% of the residents in Green Square are couples with children and 6% include sole parents plus other family. Therefore more than one fifth of the residents include households with children. Hence, building and neighbourhood design will need to consider the needs of children and families; in particular access to local schools and childcare will be important. Most of these families live in high rise apartments as 89.9% of the dwellings are high density, compared to 74.6% in City of Sydney.

2

GOVERNANCE AND AIMS

In June 2016 representatives from Sydney Local Health District (SLHD), the City of Sydney Council and representatives from community organisations met to decide if aspects of the GSURA proposal could impact on the health and wellbeing of residents, and if appropriate resources and support were available to conduct a HIA. The group agreed an intermediate level decision support HIA was appropriate and should proceed. This was led by the Health Equity Research and Development Unit (HERDU) with support from the Green Square Unit and Strategic Planning and Urban Design from the City of Sydney Council, SLHD (planning and integrated care), the Centre for Primary Health Care and Equity (CPHCE) and community organisations.

The Green Square Steering Committee was established in August 2016 to oversee the HIA process and provide feedback on assessment findings, and inform the development and implementation of the HIA recommendations. The HIA steering committee included representatives from the City of Sydney Council, SLHD, Inner City Regional Social Development Council, Tenants' Union of NSW, and the CPHCE, University of New South Wales (UNSW). The committee met three times. At the first meeting and based on the scoping process, it was decided that the HIA should focus specifically on four dimensions of health impacts: 1) transport, 2) housing affordability, 3) child health and development and 4) social and community infrastructure. At the second meeting, the assessment reports were presented and discussed, followed by a third and last meeting where the final recommendations were made.

The HIA of the Green Square Development aimed to:

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3. Strengthen the ways in which the Green Square development can promote health and reduce health inequities.

3

METHODS

This HIA consisted of the following stages:

1. The pre-screening and scoping stage determined there was a need for and value in conducting a HIA. The judgement was also made for the Green Square HIA to be a decision support one. A steering committee was convened and the range of health impacts to be studied were defined. This included:

- Housing affordability
- Transport
- Child health and development
- Social and community infrastructure

2. The identification stage involved a review of the relevant policies followed by a comprehensive review of relevant literature (peer-reviewed and grey literature). The review summarised the evidence and the potential key health impacts as well as the implications for the Green Square development (See Appendix 2-5). In addition, data from the 2017 UNSW City Futures Green Square Community Survey and the SLHD RPA HealthOne East, Green Square community consultations were also considered.

3. During the assessment phase the potential impacts to health were analysed using information gathered during the identification stage.. The result of this stage was to identify, describe and discuss the implications resulting from the GSURA. The initial assessment was carried out by HERDU: one page summaries as well as casual pathways were developed for each of the priority areas. The pathways identified the direct, intermediate and potential impacts of the development on these priority areas. These were then presented and discussed with the steering committee. Further work was then carried out refining and strengthening the assessment.

4. Recommendations. For each recommendation the following questions were considered:

- Are the impacts positive, negative or unintended?
- Are there specific populations within Green Square that would be impacted by this recommendation?

4

FINDINGS

This section of the report focuses on the results of the assessment of the potential impacts the Plan may have on health. It centres on the four dimensions previously described:

1) Housing affordability,

2) Transport,

3) Child health and development and

4) Social and community infrastructure.

For each of these dimensions a pathway was developed which described the potential direct and intermediate and health impacts the development described the Plan may have on the population. After each pathway a summary of the implications and the potential for differential effects within the population are described.

4.1 HOUSING AFFORDABILITY

As described by Baker *et al*,[13] housing is more than just accommodation. It is a group of components that together affect individuals' lives beyond and across health, wellbeing, wealth, employment and educational opportunities. Housing contributes to health with regard to the provision of safe well maintained and affordable dwellings and also by creating access to jobs, schools, transportation and services, and facilitating physical exercise and social interaction.[14, 15]

The costs associated with the provision of housing are among the largest ongoing expenses that families will incur over their lifetime.[16] The percentage of income spent on rent/mortgage impacts on what can be spent on other aspects of life such as healthy food and access to health care and medicines. Higher out of pocket rents are associated with worse self-reported health conditions and an increased likelihood to postpone medical services for financial reasons.[17] Therefore affordable housing is an important determinant of health. For example, housing tenure has shown to be indirectly and directly related to health and well-being. Studies have shown that on average people who rent have lower health compared to homeowners.[18, 19] In Australia lower income households are more likely to rent. In this case hence rent is a proxy for income status.[13]

Even though they have different meanings, housing affordability, affordable housing and other key terms are often used interchangeably in relation to housing, and are described in Table 2.

Table 2. Key terms in relationship to housing (adapted from 20 page 3)

Government subsidised housing	Non-market housing (community housing sector)		Market housing		
Social housing (including public housing)	Affordable home ownership/ shared ownership	Affordable (community rental) housing	Private market affordable rental housing (including boarding houses and student accommodation, which may be government subsidised)	Private market rental housing	Home ownerswhip
The housing supply continuum					

A number of key housing indicators relevant to health and equity are summarised in Table 3. More than half of the residents in Green Square are renters (63%) with the majority of these being private rentals. Green Square has seen an increase in median rent of 26% with the current weekly rent being higher in Green Square compared to the City of Sydney ($580 vs $565). This may create issues of housing affordability for residents (i.e. ability to pay higher rents).

A report by the City of Sydney also noted that "workers essential to the city are being priced out, this includes; nurses, teachers, cleaners, bus drivers, administrative staff, hospitality and tourism sector workers, musicians and artists".[20 page 3] This reduces the numbers of key workers that may be able to staff local services. The increase in house prices and rents "is making it increasingly difficult for middle and lower income households to afford to rent or buy in or near the city".[20 page 3] Some of the strategies the City of Sydney are undertaking to address affordable housing: a target described in the S2030 vision; inclusionary zoning to require a percentage of all new apartments to be affordable, include: housing for rental and sale of subsidised land to community housing providers.

Table 3. Housing conditions in Green Square.

Characteristic	Green Square (2016)	City of Sydney (2016)	Greater Sydney (2016)
Housing Tenure*			
Owned outright	9.3%	14.5%	27.7%
Mortgage	27.2%	20.3%	31.5%
Total owned	35.5%	34.8%	59.2%
Private rental	61.0%	55.3%	27.6%
Social rental	1.9%	9.2%	4.6%
Total rental	63.1%	64.5%	32.2%
Median rental price/week	$580	$565	$440
% local growth in median rent 2011-2016	26.1%	21.5%	
Mortgage/week	$2,300	$2,499	
Population density (per hectare)	69.36	83.90	

*Category "not stated" was not included. The assumption was made that the composition mix of those who did not respond to a question is the same as those who actually did respond. Data Sources Sources.[10, 21]

Three key areas of housing unaffordability that may have potential negative impacts include: housing stress, housing insecurity and overcrowding. Figure 3 describes the potential direct and intermediate and health impacts the Plan may have on the population. Orange means that the impact overlaps with the other assessment reports. For example, overcrowding is also relevant to child development.

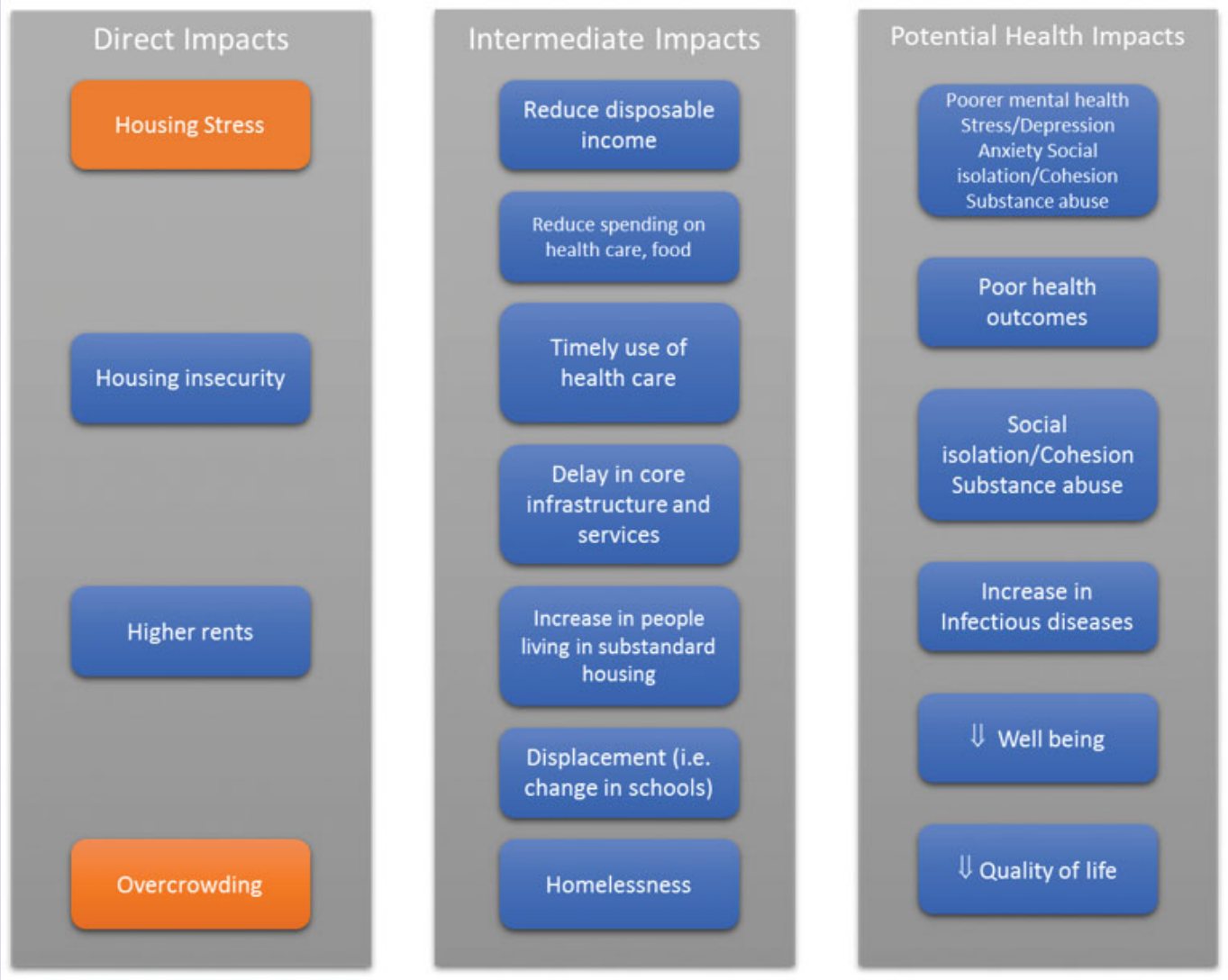


Figure 3. Unaffordable housing diagram describing the pathways from the direct impacts of the Plan to the potential health impacts for the population.

4.1.1 HOUSING STRESS

As described in Table 2 most people currently living in Green Square are renters with the proportion of those living in group households increasing from 2011 to 2016. Median rental price is also higher than the City of Sydney. Higher rent may result in less disposable income hence people are then forced to make trade-offs among housing, food, medical care, and other basic needs. This increases the likelihood that people may postpone medical services for financial reasons.[22, 23] This can also potentially create socioeconomic gradients that means housing costs are more affordable for some groups, yet can place disadvantage on others and further pushes low income earning groups to the outlying suburbs.[24] Poor housing affordability also diminishes equity and living standards, particularly those of private rental households with children that cannot cross the threshold into owner occupation, do not benefit from housing security and asset wealth, and have poorer mental health than home owners and people with mortgages.[25]

Stress related to housing issues, can adversely affect health and wellbeing,[26, 27] and may be more difficult to address than stress associated with significant life events.[28]

Potential for differential effects within the population

Populations that may be impacted include: workers on low to moderate incomes (those in the lowest two income quartiles), particularly low income families with children, and single parent households and those in rental housing.

4.1.2 HOUSING INSECURITY

Home ownership among younger Australians has declined from 36% to 25% for people aged 18 to 39 years old.[29] The sharpest decline in home ownership has been among couples with dependent children. According to Table 1 the proportion of people currently living in Green Square in this age bracket accounts for almost half (48%) of the population. There are a number of negative health effects related to housing insecurity or the permanent loss of housing. For adults, displacement can result in loss of social networks, cohesion and loss of employment.[30]

Lack of access to housing close to workplaces for lower paid "key workers" in sectors such as emergency services, education, health care, retail, and hospitality is problematic. Lower paid workers may cease living and working in the area, impacting on the provision of health and care services for the community. Alternatively they may live in the community at high cost, or live elsewhere and commute long distances, with impacts on their health and wellbeing.

Potential for differential effects within the population

Populations that may be impacted include: low to moderate income households, particularly low income families with children, and single parent households and those in rental housing.

4.1.3 RISK OF OVERCROWDING

As described in Table 3 rent is currently slightly higher in Green Square compared to the rest of the City of Sydney. The proportion of renters is also higher particularly for private rental. If this trend continues as a result of higher rents, people may accept substandard housing conditions, leading to overcrowding. Overcrowding as described in the literature has a number of negative health outcomes, including increased risk of respiratory infections, infectious diseases, mental health issues, and increased noise and stress.[31]

Potential for differential effects within the population

Vulnerable groups such as the sick, the elderly, and the unemployed are most likely to live in poor housing.

In summary, housing affordability has key impacts on health, particularly in the following areas: housing stress has very significant implications for healthy child development and for health in later life. The impacts span physical and mental health, and behavioural development. The proportion of household budgets spent on housing impacts on the family resources for other expenditures that impact on health, such as nutritious food and health care expenditures, and other necessities such as utility bills. Where families must make trade-offs between food, heating and other basic needs, including access to medical care and pharmaceuticals, there are significant implications for the health of family members.

4.2 TRANSPORT

The second assessment area for the HIA was transport. A well-functioning, integrated transport system is imperative to the development of healthy built environments. Developing such a system within Green Square faces several challenges. Many of these are common to "brown field" developments and include: poor linkages to long established arterial roads that limit pedestrian movements and amenity; increased congestion on arterial roads resulting in passing traffic using local/ neighbourhood routes; and multiple agencies having responsibility for developing a transport network.

Four key areas of transport that may be impacted by urban development and density include: changes to active transport infrastructure, changes to public transport, changes to private vehicle infrastructure and exposure to environmental hazards in the construction phase. Figure 4 describes the potential direct and intermediate health impacts the Plan may have on the population.

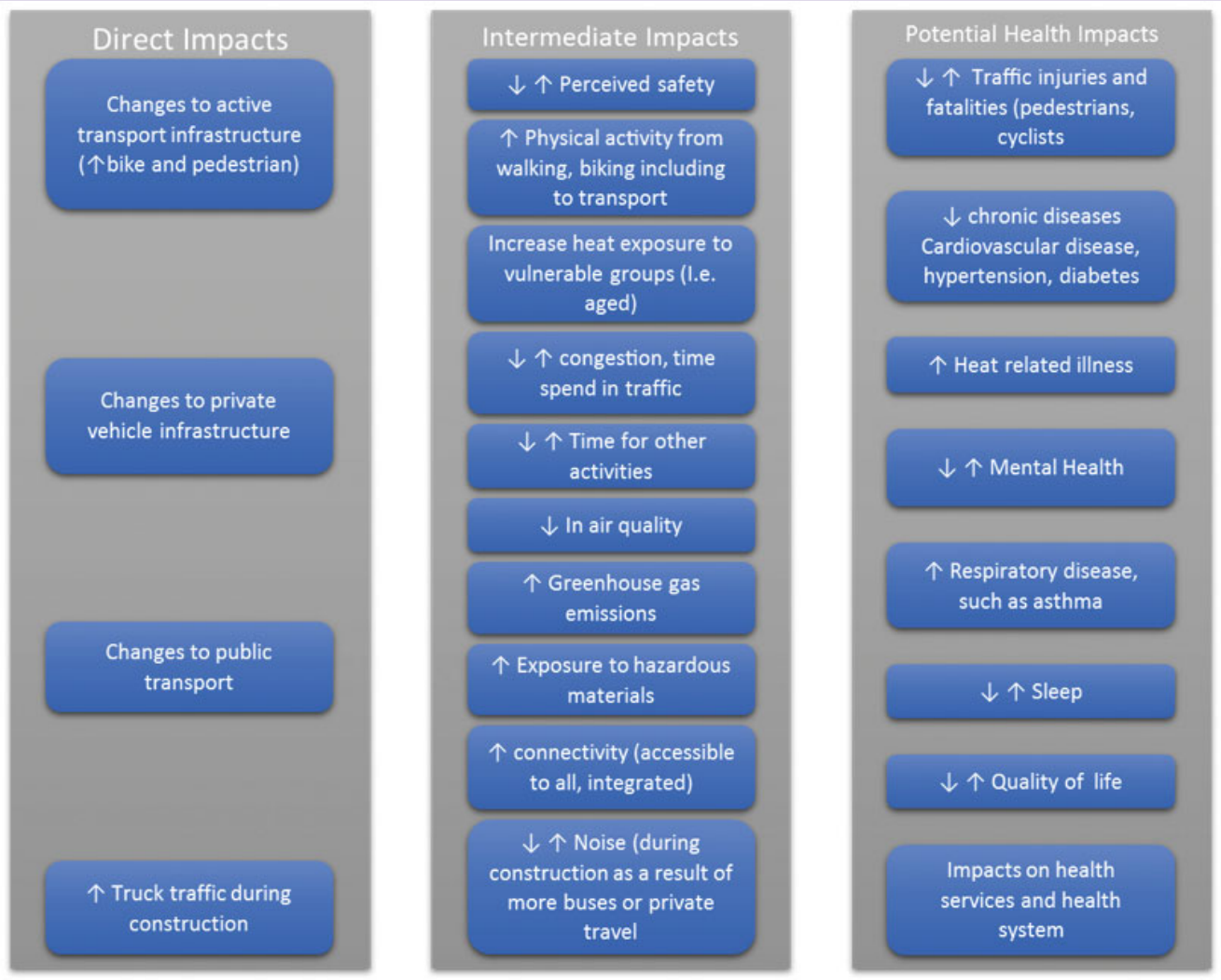


Figure 4. Transport diagram describing the pathways from the direct impacts of the Plan to the potential health impacts for the population.

4.2.1 CHANGES TO ACTIVE TRANSPORT INFRASTRUCTURE

Dramatic increase in chronic disease and other lifestyle related diseases have highlighted the role that built environment can have on improving physical and mental health.[32] The form of the built environment, such as residential and commercial density, land use mix, connectivity and accessibility, influences the way we move and what we do within that environment. In particular, the built environment can shape travel behaviour, including the quantity of walking, cycling, public transport and car travel, as well as the amount of leisure time that is available for other healthy pursuits.[7, 33, 34] Well-connected streets, mixed use facilities, services and safe paths and open space have the potential to influence walking, cycling and non-vehicle transport modes, and are associated with less private vehicle use and increased walking for recreation and transport, compared to low residential density neighbourhoods.

Approximately half (52%) of residents in the City of Sydney have inadequate physical activity, with 30% being described as overweight and 14% as obese.[35] An estimated 7.5% of adults in the area are also living with diabetes.[35] There is growing evidence that active transport encourages walking, cycling and the increased use of public transport, and has significant health benefits including; improved physical and mental health, reduced rates of chronic disease and reduced demands on health services.

Being able to walk safely in a well maintained green streetscape that has seating, shade and water can increase; sense of wellbeing, physical activity, and community connection. If residents perceive a lack of safety and a poorly maintained environment, the impact is they may not move freely within the neighbourhood, and this increases social isolation. Well-designed transport corridors reduce risks of accidents and injury. The impact of the built environment generally, and transport specifically, is discussed under the health of child development in section.[4.3]

The City of Sydney has demonstrated best practice in promoting active transport through developing cycle and walking tracks, rail, public transport and strategies to reduce car use. The Green Square area will also have the largest network of bike paths in Sydney.[9] Green Square town centre connections and accessibility features include: [9]

- integrated measures to calm traffic and enhance pedestrian connectivity, including pedestrian lanes and ways, shared zones, slow-speed streets, prioritised crossings, signalised controls, divided carriageways and through-site links.
- high quality separated cycleways within the town centre, and
- An accessible community and cultural hub on the former South Sydney Hospital site, with fine grain cycle paths connecting to the surrounding streets.

However, despite the City of Sydney's best efforts to create a walkable environment, the Department of Transport is constructing a major road from Moore Park to Alexandria that will cut through Green Square.[36]

Potential for differential effects within the population

The groups who will be most affected by a poorly integrated transport infrastructure are older people, people with disability/ mobility problems, people with long term medical conditions, families with young children and commuters who may continue to experience congestion and extended travel times.

4.2.2 CHANGES TO PUBLIC TRANSPORT

Walkability and access to public transport directly influences physical activity, weight and chronic illness. Increased use of reliable public transport is important, not only for health but also to reduce congestion and increase liveability. The roads connecting the GSURA are currently congested during peak times and are unlikely to cope with a significant increase in traffic. The area will need good public transport connectivity and walking/cycling paths. The train capacity at Green Square station is likely to be strained. The new Waterloo train station will be built after most residents have moved in, and bus services will operate to and from the city and across the development area to locations such as Erskineville and Bondi Junction. These are current and long term health risks. Other risks include:

- poor support from NSW agencies to improve public transport options
- public transport is not the responsibility of the City
- rail capacity on the Airport Line will not keep pace with development and passenger demand from Green Square
- bus capacity will not keeping pace with development and passenger demand from Green Square
- no commitment from NSW Government to implement mass transit corridor (light rail)
- arterial roads compromise pedestrian movements and amenity particularly around the Green Square train station
- increased congestion on arterial roads means that passing through traffic Green Square may use local/neighbourhood routes
- achievement of a well-connected street network may be delayed as it heavily depends on landowner's redevelopment timeframe

Potential for differential effects within the population

Households and individuals with insufficient access to public transport, including those living relatively far from public transport stops, people with disability and older people.

4.2.3 CHANGES TO PRIVATE VEHICLE INFRASTRUCTURE

As described in Table 3, 70% of people currently living in Green Square own a car with the average number of cars per household being close to one (0.94). Reducing car use has health benefits but needs supporting infrastructure such as access to taxis, car sharing parking spaces and parking for essential services. At the RPA HealthOne East, Green Square, community consultation attendees described the lack of parking as a barrier to access local health, medical staff and ambulances. Lack of parking was perceived to make general practitioner (GP) or health staff home visiting almost impossible.[37] The lack of schools in the area will mean that walking is not an alternative for many children. Private travel will then increase and so there will be a need to have drop-off points.

The Green Square Urban Renewal Area transport management and accessibility plan (TMAP).

Undertaken in 2008, described how the vision of Green Square would be best supported in transport terms by a "No Car Growth" scenario. This scenario requires a whole-of-government strategy implemented by the City of Sydney in collaboration with "State Government" to manage car parking supply, location and regulation and delivering responsive public transport provision[9].

4.2.4 EXPOSURE TO ENVIRONMENTAL HAZARDS IN THE CONSTRUCTION PHASE

Traditionally traffic emissions have been a key health risk associated with transport. This is changing as cars become less polluting. Diesel trucks however remain a problem. During the construction phase in Green Square there are opportunities to ensure that noise, dust, traffic flow and hours of access across sites to essential infrastructure, can be anticipated and addressed. Construction can also have adverse impacts on mental health, social networks and access to services38.

Potential for differential effects within the population

Some of the disadvantage groups include: local residents close to the constructions sites, children, women with childcare responsibilities, people with disabilities and older people.

4.2.5 OTHER CONSIDERATIONS

Long term impacts will also need to consider changes to transport due to society and technology. For example, the use of drones to make home deliveries, the increase use of electric cars or potentially self-driving cars. There are also changes in the nature of transport with multimodal transport increasing.

In summary, a well-connected transport system which maximises active and public transport and minimises private car transport has positive health impacts; while a heavy reliance on car transport and less use of active and public transport modes has significant negative health impacts. To contribute to the health of residents of Green Square, a built environment and transport infrastructure that encourages and enables walking, cycling, and use of public transport, and discourages private vehicle use, will therefore be important.

4.3 CHILD DEVELOPMENT

The third area of assessment for the HIA was child development. As described in Table 1, the proportion of children aged 0-4 years old grew 56% from 2011 to 2016. This is contrary to people's perceptions that families move away from apartment living when they have children. However governments have historically underestimated the proportion of children living in new high rise developments in Sydney and consequently have not adequately planned for their needs. This practice has been described as "Child Blind Planning".[39]

Development in the early years, particularly the first three years, lays the foundations and sets the trajectory for children's ongoing physical, social, emotional, and cognitive development. [40, 41] The design and implementation of healthy built environments in which young children can live, grow, and develop, has implications for health and well-being throughout the life course. As described in the transport section, the built environment can also have an impact on children's' physical activity.

Five key areas of healthy child development that may be impacted by urban development and density include: physical activity which comprises participation in active transport (walking and cycling) and outdoor play and exploration, exposure to traffic and air pollution, access to high quality local schools and high-rise developments. These have been grouped into external and internal environments. Figure 5 describes the potential direct and intermediate and health impacts the Plan may have on children.

Figure 5. Child development diagram describing the pathways from the direct impacts of the Plan to the potential health impacts for the population.

External environments

The local government is largely responsible for the external environment. In high density living children may have limited opportunities for physical activity and access to open and easily supervised space. There may also be exposure to major arterial roads limiting walkability for primary aged children and exposing children to air pollution and injury via traffic accidents. Currently there is only one mainstream primary school in the local area (within a 1 km radius of the Green Square town centre), although five have been identified as needed in the Draft Infrastructure Strategy and Plan. There is a lag in developing infrastructure as population moves.

Internal environments

High rise developments may have with insufficient space and some of it may not be child friendly.
This can cause overcrowding, parental stress and limited development opportunities for children. Children living in poorly designed and maintained housing are at increased risk of accidents (burns, falls) and weather extremes. Cold and dampness can contribute to increased risk of infectious and respiratory disease, asthma and eczema. Heat and heat island effects can lead to heat exhaustion – where children and the elderly are most at risk.

It is important to note that Green Square is an urban renewal in brownfield and the area is currently dominated by private medium and high-density housing. The literature suggests that the high density can impact residents both positively and negatively. Whitzman and Dana[42] described how children in high rise private dwellings have low levels of mobility. Easthope *et al*,[43] described how "densification" can strain local service and also put pressure on government agencies to coordinate infrastructure planning and delivery. According to a review by Haig *et al*,[44] some of the impacts associated with higher density include: access to active transport, green space, services and resources as well as environmental factors such as air quality, light and noise as well as privacy levels, networks and social interactions. These however appear not to be related to housing density per se but to the urban environment where they are situated.

Potential for differential effects within the population

Families under housing stress and families with young children are at greatest risk of the negative impacts of the build environments. Families with language barriers or with children with a disability are also at increased risk.

In summary, the implications of high density, high rise developments on child development include: pressure to keep quiet, lack of safe supervised outdoor areas and pressure to reduce floor space for play. As well as limited number of schools, lack of large open places such as ovals and basketball courts, limited safe walking or riding corridors, and “wild places” for children in the natural environment, and limited ability to supervise children playing outside.

4.4 SOCIAL AND COMMUNITY INFRASTRUCTURE

The fourth area of assessment for the HIA was the social and community infrastructure. A well-designed built environment should provide accessibility, promote physical activity, social cohesion and support healthy lifestyles and social interactions45. Social infrastructure includes facilities, places, spaces, programs that support quality of life in a community and is seen as a way of encouraging social inclusion, supporting diverse and sustainable communities, increasing access to facilities and assisting economic development.

Social cohesion and social inclusion are the outcomes of strong social and community infrastructure. Social cohesion can reflect a sense of belonging among individuals, groups and society. Social cohesion supports a well-functioning society and enables members of society to meet their full potential. Social inclusion is a related concept that focuses on the equity dimension of social cohesion. There are groups in society who are more likely to be excluded because of social, economic or physical differences.

Decreasing housing affordability and increasing density and diversity in Green Square may require more deliberate community building strategies. This can include the building design, the neighbourhood design and connections to history, culture and public art. Beside physical infrastructure, the City of Sydney also has a focus on placemaking, the physical and social aspects of place creation, and the delivery of community development initiatives. In addition, there are social and cultural programs and services, and economic development initiatives to support the new development. The City of Sydney has developed a “Placemaking Framework and Action Plan” and has a place manager to develop and coordinate implementation of placemaking strategies and programmes.[9]

The three domains that may be impacted by urban development and density and therefore are discussed in this HIA include:

- Hard infrastructure – streets, cycle ways, pedestrian routes, public transport, open spaces, drainage, energy, water and housing
- Social infrastructure – community facilities, libraries, schools, health care, leisure facilities, wayfinding and emergency services. Social spaces – especially for young people to meet.
- Community connectedness, cohesion and safety, sense of identity and connection to place and community, heritage, history and culture and public art.

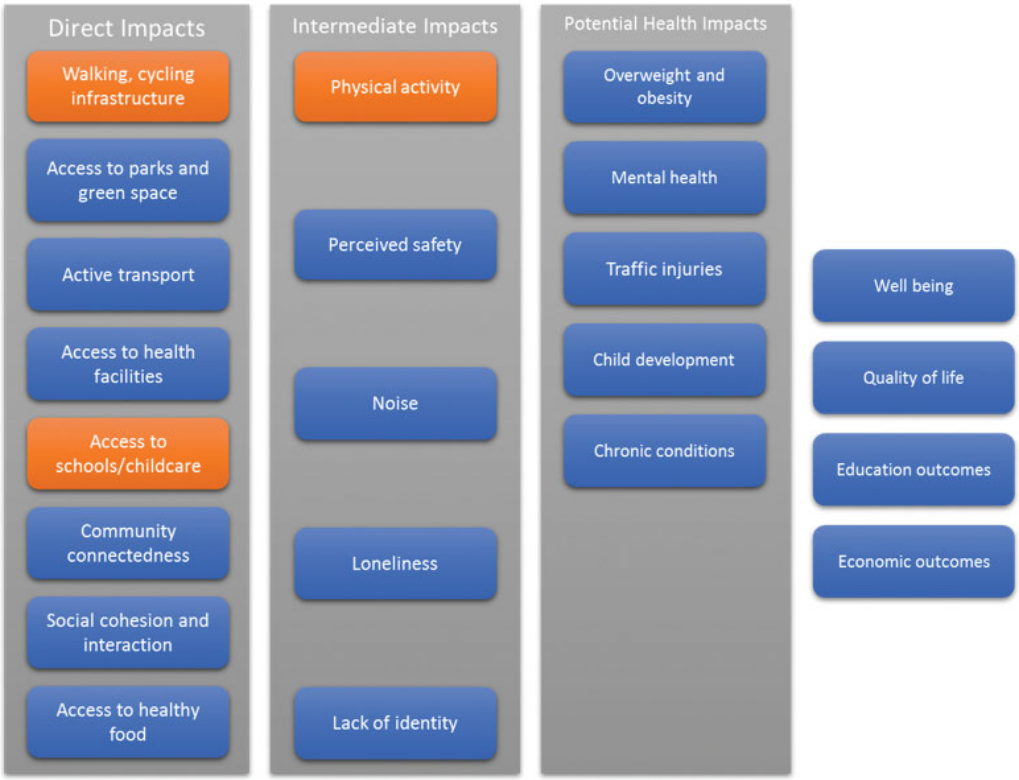


Figure 6. Social infrastructure pathway

Hard infrastructure

Given the numbers of children currently living and forecast to live in Green Square and living in high density housing, they will require ample outdoor space for play. Green spaces that provide opportunities for play, and interaction with nature will be important. As described in the literature opportunities to play, socialise and learn influence child development.[7] There is now evidence to support the relationship between features of the built environment (e.g. housing density, street design, traffic exposure, and access to parks) and some child health behaviours.[46-48] There will also be a number of new open spaces to be delivered throughout the renewal area.[9]

Physical activity is also influenced by children's neighbourhood environment, including the way children play, walk or cycle, and move around independently. Children who live in more walkable neighbourhoods with well-connected streets with safe crossing points, footpaths, interesting destinations, and low traffic volume and speed, are more likely to be physically active, and walk and cycle to destinations (including to school), when compared to children who live in less walkable neighbourhoods. The Plan does include public spaces with diversity of uses such as different play areas for different age groups.

Social infrastructure

Core community infrastructure may include children's and family services across the life cycle (preschool, childcare, youth services and aged services, and focuses on facilities for people with special needs such as disability). Infrastructure to support health and wellbeing, being delivered by the City, is diverse and wide ranging. As described in the Victorian Auditor General report as population grows, it is important that maternal and child health (MCH) services are provided in a timely manner and that kindergarten services are funded.[49] These services contribute to the health and wellbeing of children. One of the risks with the Green Square development is that there will not be enough of these services to meet the increasing demands. Hence there is a potential for long-term negative health and education consequences for children who miss out on these important services. As previously described schools and child care also play an important role in fostering social interaction and cohesion; however there is a lack of local schools, compared with the projected number of children, within walking distance from Green Square. The City of Sydney is currently in discussions to secure a 600 place primary school in Green Square town centre. In response to population growth SLHD has been funded to establish a Health One in Green Square. This innovative approach to delivering health services in the community will provide a wide range of services, including specialist outreach services and other primary care services in a new purpose built facility.

The Green Square town centre will include community facilities such as a library, aquatic centre, parks, childcare centre and a creative hub[9]. These facilities will provide an opportunity for social interaction within the local area. Residents will be able to walk to these facilities and there will be incidental opportunities to connect with other residents and the potential to create deliberate strategies for social interaction, through the library and the creative hub and also more informally, through public spaces.

Community connectedness

In 2017 the Green Square Community Survey 50 examined social cohesion and interaction and local area preferences and desires. One third of residents (31%) reported having no interaction with other people in the area. The survey also found that Green Square does not have a strong place of identity and the area is in a state of flux. The 'community' has a high proportion of time-poor people who desire more social interaction with others who live and work in the area. The survey identified the existence of smaller pockets of the population whose social interactions are limited by lower incomes, feelings of exclusion and access and language barriers. Therefore community development interventions will need to cater for those on lower incomes and experiencing language barriers and social exclusion, as well as those who are time poor and lack knowledge about the opportunities for social interaction that are available to them. The City of Sydney has committed to funding UNSW City Futures to undertake this survey every two to three years to monitor changes in social cohesion over time.

Potential for differential effects within the population

Those most at risk from social exclusion include families with young children, young people, those with language barriers and low incomes.

In summary, the provision of social and community infrastructure – or the lack of an adequate infrastructure – can have major impacts on the physical and mental health of members of urban communities, and on the level of community cohesion. It is important to ensure that opportunities to build a strong and healthy Green Square community are maximised.

Density

A common solution to unaffordable housing is for governments to increase the supply of housing in inner city areas and this leads to increases in housing density. By 2030 Green Square will be one of the most densely populated places in Australia with 22,000 people per square kilometre, while the average across all of greater metropolitan Sydney is 372 people per square kilometre. This is higher than cities such as Cairo and Manhattan (see Table 4).

A potential negative impact of housing density is insufficient infrastructure to deal with emergencies. Emergencies may arise within buildings, within the town centre or across the Green Square Renewal Area.

Table 4. Built-up urban areas by urban population density compared to Green Square Town centre.

Urban area	Density people/km^2
Dhaka (Bangladesh)	45,700
Mumbai (India)	26,000
Hong Kong (China)	25,700
Green Square Town Centre*	22,000
Cairo (Egypt)	21,900
Fisherman's Bend (Melbourne)*	17,852
Manhattan (United States)	10,194

**Development. Source* [51]

While density may increase the supply of housing in inner city areas, lower income residents have less choice and influence than other socio-economic groups and therefore are disproportionately affected by challenges of higher density living. While Green Square will increase the supply of housing, it may not result in housing being affordable. Morris and Hanckel,[52] stated that the supply and affordability of housing may be a major impediment to sustaining a diverse and economically productive local government area.

Factors that seem to be important to ensure positive health impacts of density, are the extent to which services available in high density locations are accessible to low income residents. Therefore the food supply is affordable, there is access to green spaces and local services such as health care and schools. The designs of the buildings are also important. For example, there needs to be sufficient sunlight, space for families and noise mitigation strategies.[53] Density has been included as a cross-cutting theme in all four assessment reports, due to the likely differential health impacts of density on low income residents.

5

DISCUSSION

The scope of the HIA focussed on housing affordability, transport, child health and development and social and community infrastructure. The Plan demonstrates many examples of best practice in urban design as reflected in numerous awards for planning and design. However, the HIA has identified a number of areas where changes could be made that would strengthen the potential positive impacts of the Green Square development on health and wellbeing, and mitigate potential problems. These will be discussed in this section.

5.1 COMMUNITY INFRASTRUCTURE ACROSS THE LIFECYCLE

The likely nature of the future population is starting to emerge in the 2016 census data. The population is growing faster than initially predicted, with a large number of people born overseas speaking a language other than English at home, dramatic increase in group housing, large numbers of children under 12 (8%) and a large proportion of private renters. Planning for Green Square needs to take a multigenerational approach that will see the building and land use architecture in place for decades. Planning will need to be in place across the lifecycle from young children to older people allowing for "ageing in place".

A well planned, new residential area close to the centre of a city, that offers world class sport and recreational facilities has the potential to provide a community where children can thrive once their basic needs are met. Paramount among these is a well-resourced school system. The City of Sydney is now in discussions (11th December 2017) with the Department of Education on the provision of a 600 place primary school in the Green Square town centre of an integrated community facility and school project with the City of Sydney.

5.1.1 EQUITABLE ACCESS TO LOCAL SERVICES AND COMMUNITY INFRASTRUCTURE

The plan has invested heavily in active transport infrastructure to promote walking, cycling, public transport and reduced car parking. This hard infrastructure provides an opportunity for exercise and also for social interaction. This strength is amplified by access to high quality local facilities such as the leisure centre and the library. The inclusion of local health services will also provide an opportunity for social interaction and will reduce the need to travel outside the area to access essential services. This foresight and planning provides the basis for social interaction and community connectedness. It is important these facilities are accessible to population groups across the life course and the social gradient. For example, benches and good lighting may be needed to support older residents to walk to local services and facilities.

Preserving pockets of land

Quarantining space for future developments such as schools, health services, community owned and developed facilities such as places of worship, club housing and possible co-working office spaces, are likely to be required. Although the price of land is at a premium, space cannot easily be retrofitted, yet the capacity of communities to evolve and develop is essential for them to thrive.

5.3 FUTURE PROOFING THE DEVELOPMENT

Capacity for Emergency Response

What has not been discussed in The Plan, the Assessment Reports, or in the HIA findings, is the need for an Emergency Response plan in the Green Square area. The rapid population growth, increased density and traffic congestion in bordering transport corridors will present first responders with significant challenges to respond to medical emergencies, fires, explosions or other unforeseen circumstances, which require emergency access and egress from the area and potential mass evacuations for many large vehicles. A comprehensive and tested plan is required to test if this is feasible without design modifications at this early stage.

The impact of climate change

This is already on the City of Sydney agenda considering the urban heat island effect and for example trialling the use of a lighter-coloured pavement in some areas of the City and providing good canopy coverage on streets. In Green Square a potential way of reducing this impact, and to increase local amenity and mental wellbeing, could be by the development of an urban forest or large regeneration areas on land not suitable for intensive development. The City of Sydney "Green Liveable Network" provides opportunities to do this.[9] Ensuring the green corridor becomes a reality and Open Space requirements of the City are met will have substantial health benefits. As described by Thomson *et al*,[54] one of the priorities in designing high-density residential areas is the availability of different types of green space easily accessible to everyone.

There is also strong evidence linking thermal comfort and natural ventilation with health.[55] Foster *et al* [56], described that natural ventilation, thermal comfort, sunlight, and acoustic privacy are linked to health. There is less guidance on these in the apartment design policy across Australia. Moore *et al* [55], also described how the current minimum building requirements fall significantly short of what is required for a transition to a sustainable, low carbon future. Internationally, the United Kingdom and Canadian governments have developed plans for new housing to improve minimum housing performance regulations to a near zero net energy performance. The City of Vancouver has an emission reduction target of zero emissions for all new buildings by 2030.[55] Similar measures are yet to be adopted in Australia.

Technological developments

The technological developments over the next 50 years are not possible to predict but are likely to include electric and driverless cars, drones and changes in work practices related to digitalisation. The City of Sydney will need a process for identifying and managing these challenges. For example the addition of electric vehicle charging stations.

RECOMMENDATIONS AND CONSIDERATIONS

It is important to have a coordinated and timely approach by those responsible for providing infrastructure and services, and there is a need for effective integration of strategic planning.

The next section will describe the recommendations and considerations. These have been labelled as:

- **RED**: Priority issue requiring immediate action with the likelihood of having significant health impact. Needs serious review.
- **ORANGE**: Proceed with caution and potential for negative health impacts.
- **GREEN**: Proceed with ongoing monitoring. Positive health impacts

RED: Priority issue requiring immediate action with the likelihood of having significant health impact. Needs serious review

Emergency Preparedness

Issue	Potential Impact	Recommendation	Agency responsible
Green Square must have a comprehensive and tested emergency preparedness plan to deal with fire, explosions or other emergencies that require ease of access and egress for first responders. Currently different agencies have various mandated responsibilities under SERMA and then HEALTHPLAN. However, there is no particular focus on high rise living.	Increased density and building/street design may make it difficult for emergency services to enter and leave the area and move across arterial roads or park and cope with mass evacuations. Such emergencies can have fatal and catastrophic short and long-term impacts on the victims.	A comprehensive disaster management and preparedness plan to be developed and routinely tested. The plan needs to be integrated with the state disaster plan, and developed according to international standards.	NSW Government, and the City of Sydney

Schools

Issue	Potential Impact	Recommendation	Agency Responsible
There is only one mainstream public primary school within one km of Green Square. Despite the 2016 census identifying over 2,000 children under 12 living in the area.	Children need access to schools that are high quality that are not overcrowded and within safe walking distance. Reduced physical activity, overweight and obesity in children. Severe lifelong health implications including higher risks for: ■ Type 2 diabetes ■ Cardiovascular disease ■ Some cancers ■ Breathing and sleep problems ■ Bone and joint problems ■ Depression and other mental health problems Until there is a school within safe walking distance the Department of Education needs to provide safe drop off and pick up areas.	An appropriate number of primary schools should be established in Green Square as a key health priority. Commitment to providing adequate school is commensurate growth. Commitment to providing adequate schools by Department of Education should be sought. In the absence of a school an alternative mechanisms of transport needs to be established. This could include: school buses and drop off points, village to village bus. If no buses are available a car park next to the school is needed.	Department of Education Partner agency City of Sydney Civil Society Organizations.

Transport infrastructure

Issue	Potential Impact	Recommendation	Agency responsible
Central to the healthy urban development is active transport that promotes walking, cycling and the use of public transport to reduce car use.	Reduced levels of safe walkability and cyclability for children and families. Impact on traffic congestion and jeopardise the City of Sydney's investment in active transport.	The City should advocate for (each of the 8 factors critical to implementation- See Appendix 1) to be urgently reviewed and revised.	City of Sydney (for advocacy). TfNSW (for provision of adequate public transport)

Permeability/connectivity

Issue	Potential Impact	Recommendation	Agency responsible
Central to the healthy urban development is active transport that promotes walking, cycling and the use of public transport to reduce car use.	Reduced levels of safe walkability and cyclability for children and families. Impact on traffic congestion and jeopardise the City of Sydney's investment in active transport.	The City should advocate for (each of the 8 factors critical to implementation – See Appendix 1) to be urgently reviewed and revised.	City of Sydney in partnership with TfNSW

Secure housing tenure

Issue	Potential Impact	Recommendation	Agency responsible
At present the majority of people in Green Square are renters with substantial people living in group houses. Length of renting tenure and rental conditions need to be improved to allow secure tenure.	Risk of overcrowding, exploitation of students, failure to maintain and address tenant issues, reduce diversity of population. Housing tenure is one of the housing dimensions that has an impact on health and well-being	Review of the demographic assumptions and policies. Reform the way the Residential Tenancies Act 2010 works and also build to rent. Explore the potential to deliver rent-capped subsidised affordable rental housing designated for lower income-earners and key workers.	State Government

ORANGE: Caution Potential for negative health impacts

Healthy internal environments for children

Issue	Potential Impact	Recommendation	Agency responsible
Internal environments limit opportunities for child development	Potential impacts on child development which arise from lack of adequate space and lack of safe outdoor play opportunities include; reduced physical activity, behavioural problems, social withdrawal, and poor academic performance.	Review of building size, wall thickness and storage spaces. Building codes that supports child development. Consider indoor playing areas or similar area. Involve children in the design.	Department of Planning lead agency and partners include SLHD and Government architect.

Green Space

Issue	Potential Impact	Recommendation	Agency responsible
Lack of green space proportionate to people	Green space is important to promote outdoor activity across the life cycle especially for children, older people and those who are socially isolated.	The City of Sydney efforts to provide a variety of age appropriate open spaces is recognised including parks such as the Drying Green, and Gunyama Park, but more green space is needed. To improve the quality and capacity of open spaces (given opportunities to increase the provision of these spaces is limited). The green grid needs to be actively protected.	City of Sydney

Mitigating the effects of climate change

Issue	Potential Impact	Recommendation	Agency responsible
There is a need to minimise the effects of weather extremes and reduce greenhouse emissions	Decrease the urban heat island effect. Older and younger people at risk of heat exhaustion	The City of Sydney is trialling a lighter-coloured pavement in other areas and monitoring the impact of heat. Target minimum canopy cover on streets. Increase open green space. Support for the development of a green forest, urban corridor. Zero emissions for new buildings	City of Sydney (heat island) Department of Planning (building regulations)

Preserving pockets of land

Issue	Potential Impact	Recommendation	Agency responsible
Lack of space for future developments such as schools, health services, community owned and developed facilities such as places of worship, club housing and possible co-working office spaces. Shared community owned spaces. Central spaces might not meet the granular issues around the neighbourhood, need neighbourhood meeting places	Decrease social interaction, isolation and loneliness. Commercial gentrification Lack of spaces for adolescents to meet	Reserve pockets of land for affordable spaces that enable community-led social groups	Lead agency is City of Sydney, partners include other government agencies who own land in Green Square

Living on a building site

Issue	Potential Impact	Recommendation	Agency responsible
Many residents will be living on an active building site for many years.	Residents exposed to dust, noise, traffic, flooding and difficulty traversing the area to access services and shops etc. Diesel trucks are major sources of air pollution. Children, older people and those with respiratory disease are particularly vulnerable.	Guidance should be developed on ways in which these potential negative impacts can be mitigated. SLHD to include this in the “Building Better health guidelines”	SLHD with NSW Health City leading the way for Green Square on the construction liaison position.

Technological development

Issue	Potential Impact	Recommendation	Agency responsible
Technological development can be anticipated to have implication for development and design	Developments such as electric cars, driverless cars, drones and the need for local technology hubs can be anticipated and likely to have infrastructure implications.	That a process be established to “future proof” Green Square.	City of Sydney

Planning across the life course

Issue	Potential Impact	Recommendation	Agency responsible
The population will change and age over time. Infrastructure planning needs to consider how this may impact on transport and social and community infrastructure.	Ageing in place promotes health, well-being and the ability to live longer in the community. People who have a disability or ageing will require a wide range of housing options including hostels and nursing homes. Supported accommodation may also be required for some groups. Provision for these facilities needs to be made while there is still land available.	Processes for quarantining of land for aged care facilities should be developed. Habitat III is the international benchmark that should be pursued. Allow places to be modified to suit the needs of older residents. For example reinforce the bathrooms and stairwells so that modifications become possible.	Commonwealth Government State Government

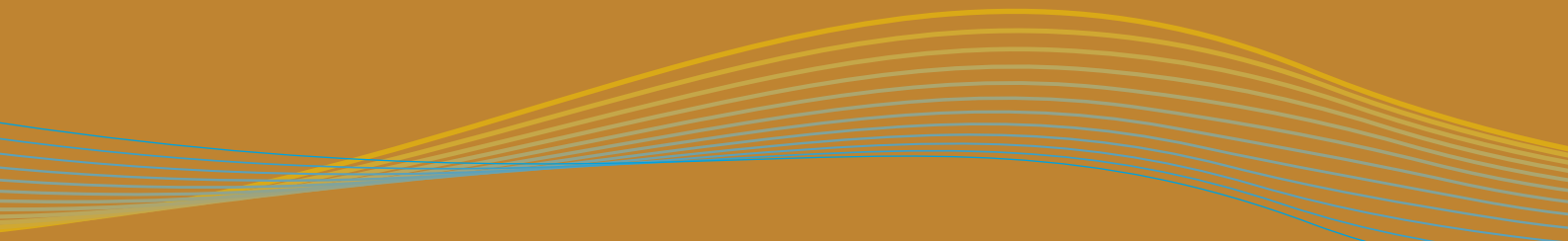
Green: Proceed with ongoing monitoring. Positive health impacts.

Social and community infrastructure

Emer	Potential Impact	Recommendation	Agency responsible
Leisure facilities that provide opportunities for social interaction and exercise: library, aquatic centre, and the Bangla community shed. There are 2 groups who may need additional attention: young people and migrant groups.	This investment in infrastructure will have significant health impacts. Young people and the high number of migrants in the area will require different social and recreational infrastructure.	The City of Sydney efforts to provide leisure facilities should be recognised and applauded. A forum on youth and migrant social and recreational infrastructure to be held in collaboration with SLHD and local youth services	City of Sydney SLHD, City of Sydney, local youth services and young people.

Provision of health services

Emer	Potential Impact	Recommendation	Agency responsible
Provision of comprehensive health services through HealthOne. HealthOne will be in place by 2020 In the interim a range of community health services are currently being provided in the area. Which include: Child & Family Health, Sydney District Nursing & Specialist Services. As well as other programs such as home visiting programs and breastfeeding support clinics.	High quality health services will have a positive health impact on the community and reduce the need to travel outside the area for health services.	SLHD continue to fund and support the development of the Green Square HealthOne. Outreach services to be provided for particular at risk and disadvantage groups such as: LGBTIQ and Aboriginal and Torres Strait Islanders.	SLHD



LIMITATIONS

The HIA has some limitations. Firstly, the community profile data were based on people currently living there. The assumption was made that people that move into the area will be similar. Secondly the HIA was done with health and experts but intersectorial input would have been favourable (i.e. education, transport). However the HIA had regular input from the interdisciplinary steering committee about the interpretation of the findings and the development of the recommendations. The recommendations were also presented to diverse audiences at a number of forums.

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Appendix 1: Eight factors critical to implementation The Plan

1. Poor support from NSW agencies to improve public transport options.

2. Public transport is not the responsibility of the City.

3. Rail capacity on the Airport Line will not keep pace with development and passenger demand from Green Square.

4. Bus capacity is not keeping pace with development and passenger demand from Green Square.

5. No commitment from NSW Government to implement mass transit corridor (light rail).

6. Arterial roads compromise pedestrian movements and amenity particularly around the Green Square train station.

7. Increased congestion on arterial roads means that passing through traffic Green Square may use local/neighbourhood routes.

8. Achievement of a well-connected street network may be delayed as it heavily depends on landowner's redevelopment time frame.

Appendix 2: Housing Affordability Assessment Report

The significance of housing affordability with respect to health

> "Adequate housing is a basic necessity and human right which impacts on education, health and employment outcomes, as well as the overall well-being of the population. Having a private place to be which is decent and over which we have some real control is fundamental to the well-being of every one of us as individuals and communities. In this sense, affordable housing is both vital economic and social infrastructure"[1].

Housing is one of the most basic needs for families, and yet for many Australians access to secure, affordable housing is increasingly difficult. The costs associated with the provision of housing are among the largest ongoing expenses that families will incur over their lifetime[2], and housing costs have been increasing in Australia relative to incomes for some years. The decline in housing affordability in Australia can be expected to have wide-ranging impacts on individuals and families, including impacts on physical and mental health.

This assessment report examines available evidence relating to the health impacts of housing affordability. It aims to inform refinement of the Green Square Urban Renewal Area. At Section 2 of this report we discuss the policy context for housing affordability. At Section 3 we summarise the literature regarding the groups most at risk of housing stress, the relationships between housing and health, and the impacts of housing unaffordability on health. Section 4 summarises the findings of the literature review in tabular form; while in Section 5 we examine the likely health impacts of the Green Square development, with reference to housing affordability.

The term "housing affordability" usually refers to the relationship between expenditure on housing (prices, mortgage payments or rents) and household incomes[3]. When the cost of housing increases relative to incomes, housing affordability is reduced. The term "housing affordability" is distinct from the term "affordable housing", which has been defined as "housing of an adequate basic standard that provides reasonable access to work opportunities and community services and that is available at a cost which does not cause substantial hardship to the occupants"[2]. Affordable housing includes government-funded public or social housing, as well as housing provided through other means, with the key

feature being that this housing is generally provided at below market price to households on very low to moderate income earners, and the cost paid by the household is generally calculated as a proportion of household income or a proportion of market rent in the locality. Poor overall housing affordability will usually result in an increased need for lower-cost or affordable housing.

The concept of “housing stress” is also central to this paper. A household is typically described as being in housing stress if it is paying more than 30% of its income in housing costs. As higher income households can spend a higher proportion of their income on housing without experiencing problems, they are often excluded from these types of analysis. Consequently, a ratio of 30/40 is often used as a benchmark—that is, if households that fall in the bottom 40% by income spend more than 30% of their income on housing, they are defined as being in housing stress[3].

This paper takes a broad focus on the health impacts of declining housing affordability and increased housing stress, and also discusses the consequent need for a greater supply of affordable housing. Housing affordability in Australia, and in Sydney in particular, has declined significantly over recent decades. Causes and consequences of the decline in housing affordability in Australia and particularly Sydney, including the consequent increase in housing stress, are discussed further at Appendix 1. Safe, secure and affordable housing is fundamental to physical and mental health and well-being. It is important that quality and security of housing are considered alongside affordability, as these aspects and their health impacts are closely interconnected.

In the context of growing social and health inequities and the increasing burden on health services, it is vital for policy makers to understand the pathways through which housing affects health. The literature review undertaken for this paper provides evidence of the multiple links between housing affordability and health status. Affordable housing makes more household resources available to pay for healthy food, health care, and community participation. Where families must make trade-offs between nutritious food, heating and other basic needs, including access to medical care and pharmaceuticals, as well as participation in social activities, there are significant implications for the health of family members.

Housing stress and related poverty has very significant implications for healthy child development and for health in later life. The impacts span physical and mental health, and behavioural development. Housing stress can lead to families living in sub-standard or

overcrowded housing, with higher risk of disease and injury amongst vulnerable people such as children, the sick, the elderly, and the unemployed.

Stable and affordable housing supports mental health by providing control over one's environment, limiting stressors related to financial burden or frequent moves, and in some cases offering an escape from an abusive home environment. Conversely, housing unaffordability and insecurity is correlated with worse mental health. Affordable housing linked to good social infrastructure can also serve as a platform for providing supportive services to overcome social isolation and improve the health of vulnerable populations, including through access to employment and positive social networks, and to healthy food, walkable neighbourhoods, transport, education, essential services and recreation. Finally, lack of housing affordability is a key driver in homelessness, with over 100,000 Australians homeless on any given night and at high risk for a range of physical and mental health problems. These relationships between housing affordability and health, and the implications for the Green Square development, are explored further below. Consideration of these impacts is vital in ensuring housing affordability issues are adequately addressed in the Green Square development, to promote the health of the population of the area.

Policy context

Global policy context

The World Health Organisation (WHO) has an interest in housing as a setting for and social determinant of health[4], and has called for international guidelines on healthy housing[5]. One of the sustainable cities and communities United Nations Sustainable Development goals - Goal 11 is to "Make cities inclusive, safe, resilient and sustainable" and the target 'By 2030, ensure access for all to adequate, safe and affordable housing and basic services" [6]. The WHO has also outlined four interlinked levels at which housing can have health effects:

- the physical structure, including factors such as mould growth, quality, design, and noise exposure;
- the meaning of "home" as a protective, safe and intimate refuge where one develops a sense of identity and attachment;
- the immediate housing environment, including the quality of urban design (such as public services, playgrounds, green space, parks, places to socialise); and
- the community, that is, the quality of the neighbourhood and its relation to social cohesion, sense of trust and collective efficacy [7].

A 2007 examination for the Australian Housing and Urban Research Institute (AHURI) of a range of national policy responses to housing issues[8] identified six broad clusters of national policy themes across nations:

- Facilitating home ownership for new entrants and lower-income households.
- Promoting private investment in affordable housing.
- Using the existing private rental market.
- Reinventing social housing.
- Promoting housing and neighbourhood sustainability.
- Developments in governance and delivery of housing systems.

The authors noted that in comparison with other nations studied, "Australia… has experienced declining national expenditure and little by way of strategic policy developments in housing over a decade or more, despite research evidence and broadly based advocacy in favour of innovative action" [8].

National policy context

Governments play a significant role in the Australian housing market, directly through housing assistance and indirectly through policies associated with land planning and taxation. Direct assistance includes social housing, home purchase assistance and rent assistance. Housing assistance is provided by governments because many Australian households face problems in acquiring or accessing suitable private accommodation — either through renting from a private landlord or through owner occupation — for reasons including cost, availability, location and/or adequacy. The Australian Government provides funding to assist with the achievement of housing and homelessness related outcomes for which states and territories have primary responsibility[9].

Expert analysis a decade ago concluded that in Australia, "influential and related policies that lie at the core of investment in the housing sector (such as those for superannuation savings and retirement incomes, property linked tax incentives/concessions, and policies related to urban planning, land supply and land development) are not co-ordinated and do not have integrated objectives in relation to housing"[8]. It is notable that political debate continues at national level regarding the drivers of and solutions to the increasingly acute housing affordability problem in many Australian cities and towns, including debate regarding the role of taxation policy in relation to this issue.

Infrastructure Australia's document *Our Cities, Our Future: A National Urban Policy for a Productive, Sustainable, and Liveable Future, 2011* represents the overarching national strategic framework for urban development in Australia[10]. The policy recognises that affordable living is not just about the capital cost of housing – it also includes the cost of transportation and maintaining a home. The trend for less affluent households to live in outer lying areas of cities where housing costs are more affordable, is noted as having the consequence that these households carry a higher cost burden for transport and are particularly vulnerable to increasing petrol prices. The policy states that coordinated development of housing, facilities and services must occur in existing and new urban areas of our cities. The policy lists relevant national initiatives supporting affordable living choices, including a $20 million *Liveable Cities* fund to invest in demonstration urban development or renewal projects that improve access to jobs and housing and enhance the liveability of cities; and improve urban design outcomes to deliver higher quality public spaces and streetscapes to benefit local businesses, communities and visitors. Housing affordability is one priority for these projects.

The Commonwealth has a number of agreements with the States/Territories that are relevant to the provision of affordable housing[11]:

- *National Partnership Agreement on Remote Indigenous Housing (NPARIH)*: A subsidiary agreement to NAHA with the principal aim of ensuring that Indigenous Australians have the same housing opportunities as all Australians. It is a designed to address significant overcrowding, homelessness, poor housing and severe housing shortages for Indigenous communities.

- *National Partnership Agreement on Homelessness (NPAH):* Focuses on prevention and early intervention to stop people becoming homeless, breaking the cycle of homelessness and improving and expanding the service response to homelessness. The agreement has two headline objectives: halve overall homelessness by 2020; and offer supported accommodation to all rough sleepers who need it by 2020.

In addition, the Commonwealth Government provides eligible income support recipients with *Commonwealth Rent Assistance (CRA),* in recognition that many renters in private or community housing cannot afford to pay market rent. It is intended to ensure that adults with limited means can afford to live in rental housing that satisfies adequate standards.

Housing affordability, the unmet need for affordable housing, and homelessness are

becoming increasingly prominent national political issues. Following a 2013 Senate referral and a subsequent inquiry, in May 2015 the Senate Economic References Committee produced a report, *Out of reach: The Australian housing affordability challenge*[11] which concluded that:

> "Considering the vital importance of housing to a person's overall wellbeing and the current problems gaining access to affordable and appropriate housing, the committee is convinced that access to affordable housing is a matter of national importance. Furthermore, affordable housing should be a national economic issue that needs to be a central and cross-cutting theme of government. The committee believes governments, including the Australian Government, have a legitimate role, and indeed a responsibility, to use policy interventions to improve the efficiency, efficacy and, critically, the affordability of the housing market."

The report made 40 recommendations aimed at improving housing affordability and access to affordable housing, including social housing.

On 7 January 2016, the Federal Government announced that the COAG Council on Federal Financial Relations would form an Affordable Housing Working Group. This group has been charged with identifying ways of increasing the supply of affordable housing for people on low incomes and implementing trials of models of such arrangements. To this end, the Working Group released an issues paper[12] and called for submissions on ways to boost the supply of affordable rental housing through innovative housing models. The consultation process was completed on 6 April 2016. The Affordable Housing Working Group is currently considering the merits of various approaches to the provision of affordable housing, and AHURI researchers have undertaken a significant amount of research on Housing Supply Bonds and an Affordable Housing Finance Corporation Model.

State of New South Wales policy context

The NSW Government has indicated its appreciation of the relationship between built environments and health, acknowledging the strong evidence demonstrating the links between chronic disease and lifestyles characterised by car-dominated transport, reduced opportunities for exercise, increased fast food availability and lack of social connection; and developing strategies to address physical activity opportunities, healthy food access, and opportunities for social and community interactions[13].

The NSW Government in December 2014 published *A Plan for Growing Sydney*[14], a new overarching strategic plan for Sydney for the next 20 years. The strategy prioritises intensive development of several strategic locations within Sydney, including Green Square, with growth in these locations seen as critical to sustaining and expanding the economy and supporting more jobs closer to where people live.

The *State Environmental Planning Policy (Affordable Rental Housing)*[15] was introduced in 2009 and amended in 2011, to increase the supply and diversity of affordable rental and social housing in NSW. The Affordable Rental Housing SEPP provides incentives for some residential developments when they include affordable housing as well as encouraging new affordable rental housing that is compatible with its surroundings and in locations that are well served by public transport. It covers housing types such as villas, townhouses and apartments which contain an affordable rental housing component; secondary dwellings (also known as granny flats); new generation boarding houses; group homes; social housing; and supportive housing. As outlined below, this SEPP provides the framework for the delivery of affordable housing in the Green Square development.

Voluntary Planning Agreements (VPAs) are agreements between the developer and the planning authority. Under these the developer can agree to fund affordable housing. This could be done by "the dedication of land, monetary contributions, construction of infrastructure [and] provision of materials for public benefit and/or use" [17]. The City uses these agreements to negotiate the provision of affordable housing[18].
There are also provisions for affordable housing through the Greater Sydney Commission's draft District Plans, including requirements for Councils to show how they will deliver affordable housing through local housing strategies. The Commission has recommended a 5 to 10% levy on all new developments[16].

City of Sydney policy context

The City of Sydney's *Sustainable Sydney 2030* is a set of goals to make Sydney as green, global, and connected as possible by 2030. One of the key goals is that: "Relative equality will be improved through increased affordable housing and better access to community facilities, programs and services across the local area"[19].

In March 2015 the City released the *Green Square Draft Infrastructure Strategy and Plan*, which sets out in detail the history of the site, the current status of development, and plans for the future. The Strategy recognises affordable housing as a critical part of the social infrastructure that will facilitate the sustainable growth of Green Square. The Strategy

acknowledges that because of the cost of private accommodation in the City, it is unlikely that affordable rental housing will be delivered by the market[20].

The City's *Sustainable Sydney 2030: The Vision* and the *Affordable Rental Housing Strategy*[21] established a target that 7.5 per cent of housing will be social housing and 7.5 per cent of housing will be affordable housing by 2030. While this is not adequate to meet the need of medium and low income people experiencing severe housing stress it is more ambitious than any State government initiative. Currently, housing supply in the City comprises 9.8 per cent social housing and 0.7 per cent affordable housing, with about another 8,000 affordable housing dwellings required across the City to achieve the 2030 target[13].

Potential health impacts of housing affordability

The population at risk of housing stress

The Green Square and City South Village estimated resident population in 2011 was 20,013 people, and this is projected to grow to at least 54,170 by 2030[22] (note that latest figures on the City of Sydney Green Square website now put this estimate at 61,000)[13].

Demographic data indicate a culturally diverse population, with 53.4% of Green Square and City South Village residents born overseas, and 41.8% coming from countries where English is not the first language. The three top ranking countries of birth were Australia, Other Asia, and China (including Hong Kong). At home, 45.7% of residents speak a non-English language either exclusively, or in addition to English – far higher than the average of 34.4% for the City of Sydney overall[22].

There are currently 11,343 dwellings in the Green Square Urban Renewal Area (GSURA). This is estimated to increase to over 33,000 dwellings by 2031. As noted above, the target for the City of Sydney local government area (LGA) is that 7.5% of dwellings will be affordable housing, a proportion of these dwellings will be built in the Green Square development if the GSURA is to reflect the City target; but progress to date against this target is slow[20].

Particular attention should be paid to the impact of housing unaffordability on households at higher risk of housing stress. The evidence indicates that the households most at risk include:

- Low-income households: The 2015 Rental Affordability Index shows households in the lowest income bracket have been particularly at risk of housing stress because the rent to income ratio has increased the most. The proportion of low-income households experiencing rental stress increased from 66% in 2008 to 70% in 2011. Ninety five percent of Sydney's very low income earners were in housing stress at the time of the 2011 census[23]. At the time low-income families earning $500 a week would need to spend 65 per cent of their income to rent a property [24]. There is effectively no affordable rental housing in Greater Sydney for people in the bottom 40 per cent of incomes. This includes the second income quintile family households, working families earning around $1,019 per week[25]. Consistent with ABS data, 20% of the Household, Income and Labour Dynamics in Australia (HILDA) cohort was exposed to one or more episodes of unaffordable housing in the decade from 2001 to 2011[26]. These were mostly people with incomes below the 40th percentile of the income distribution[26].

- Single parent families and single person households: In Greater Sydney one parent families and one person households far more commonly experienced severe rental stress (23% and 34% respectively) compared with 18% of couples with children and 12% of couples with no children. Only 7.5% of people living in group households experienced rental stress[22].

- Low-income families with dependent children: Particularly vulnerable are those with very young children (aged under five years) and dependent children in their adolescent or young adult years (15–24 years)[25]. Housing related cost of living pressures impact strongly on families with children because once children reach late teenage years they require separate bedrooms, and infants will similarly add to family size and space demands. Infants will also prompt lower employment participation from (typically) female partners.

- Low-income migrants from non-English speaking backgrounds: It may be that these migrants find it more difficult to navigate pathways into sustainable affordable housing due to language difficulties, lack of familiarity with institutional practices in Australian housing markets, or discrimination in housing markets[25].

- The unemployed, those not in the labour force and workers on casual job contracts are prone to housing stress[25].

- The self-employed are consistently over-represented in groups experiencing housing stress. This may be attributable to the variable nature of their disposable incomes. The variance measures based on self-employed disposable household incomes are roughly twice those in the rest of the workforce. Furthermore, the navigation out of housing stress and the ability to sustain affordable housing has become more difficult as rents increase.

- Older people who do not own their own homes: Home ownership allows many older Australians living on relatively low incomes post retirement to have housing security. The proportion of older Australians (65 years and above) owning their home has declined from 79 per cent in 2005 to 73 per cent in 2011[25]. The increasing proportion of older people renting increases their vulnerability to housing stress and unstable housing tenure as they have less income to contribute to housing and greater medical expenses as they age[27]. In 2011, one in 20 (5%) of older people living in Greater Sydney experienced mortgage stress and one in 19 (11.5%) experienced rental stress[28]. The AHURI projects the number of people aged over 65 years living in low-income rental households to more than double from 195,000 in 2001 to 419,000 in 2026[29, 30].

- Lower paid "key workers" who live and work in inner city areas: These workers experience significantly greater housing affordability problems compared to those who work in the inner city but live elsewhere[31]. These "key worker" occupations are necessary to the efficient functioning of a community and the business economy, and this category includes occupations such as emergency services, teachers, and nurses, and those working in service industries such as retail and hospitality[32]. Hospitality is important to high amenity environments in the inner urban area to attract businesses and subsequently employees, and enables the inner urban area to sustain higher value added business activity[33]. The impact of housing affordability on this group has far-reaching implications which are discussed below.

The literature review undertaken for this paper confirms that housing stress has multiple impacts on the mental and physical health of individuals and families. The literature in relation the health impacts of housing affordability is explored below, following which the implications of each of these issues for the Green Square development will be discussed. The literature review first examines the overall literature on the links between housing and health, and then focuses on the following key areas in relation to the impact of housing affordability on health:

- The impact of housing affordability on mental health status.
- The impact of housing affordability on people's ability to live close to workplaces.
- The physical health impacts of access to affordable housing of acceptable quality.
- The health impacts of access to social infrastructure and amenity.
- The health impacts of housing affordability in relation to household expenditure on food and other essentials.
- The impacts of housing affordability on healthy child development.
- The impacts of housing affordability on homelessness and health.

Overview of the literature on the links between housing and health

Recognition of the links between housing and health is not new. This has been a foundational issue for public health since Edwin Chadwick made the connection between poor housing conditions and health problems in 1842. Chadwick identified that poor quality housing, lack of sanitation, inadequate ventilation, poor waste disposal and unsafe construction and overcrowding provided fertile ground for the spread of infectious diseases that resulted in high levels of death and disability at that time[34].

In contemporary Australia, urban planning policies, legislation and regulation are in place which aim to maintain the health of urban populations, for example through effective sanitation and wastewater management, building standards, and indoor air quality. There has been significant progress in improving the safety and quality of housing. The "hardware" of housing and building standards have improved, and well built and maintained housing promotes population health. The focus has now shifted from individual houses to built environments, and to the less direct impacts of housing (the "software") in providing access to work, food, transport, community and social infrastructure. For example, urban form can impact on risk for chronic disease by promoting or inhibiting physical activity, access to fresh food, or to community infrastructure which promotes good mental health[35].

Although there is a strong association between poor housing and poor health, it has been difficult to establish a causal relationship[26]. A review of Australian literature[35], found that most published studies conclude that housing plays an integral role in the maintenance of health. However, it is widely acknowledged that a range of other interconnected socioeconomic factors also significantly influence health status. These socioeconomic factors are difficult to control in a research setting and it is therefore difficult to isolate the specific health costs or benefits attributable to housing, as opposed to other linked factors. Another Australian review of housing conditions and health inequalities[36] also concluded that

while numerous reviews and studies show an association between housing and health the direction of causality is often not clear. It has further been shown that average levels of health hide the effect of socioeconomic inequality within urban areas. Rich and poor people live in very different epidemiological worlds, even within the same city[37], which is important to take into account given the strong correlation of socio-economic status and health status.

Bridge et al,[38] note that research into the relationship between health and housing, while profuse, has to contend with many confounding factors. For instance, poverty, poor nutrition, violence, exposure to weather, pest and toxins, social isolation and self-damaging behaviours, such as drug addiction, are typically observed concurrently in poorly housed populations, and all have been linked to poor health. These confounding factors will mediate the impact of housing on health outcomes, and as with other non-shelter outcomes, these complex interrelationships make identification of causality problematic. The authors note that failure to demonstrate causality is unsurprising given the complexity of relationships, the lack of control and comparison groups, and the high prevalence of correlational research, in combination with selection bias and poor control for demographic variables.

Residential stability has been identified as one of the most important predictors of health status across the life course. Moving can result in job loss, difficult school transitions, and the loss of health protective social networks. Adequate housing in the early years is essential for healthy childhood development and health and social outcomes later in life. The proportion of people retiring without owning a home is increasing, which will severely impact their ability to afford housing and health care costs.

Tenure insecurity and housing stress are part of a larger picture of housing disadvantage for many Australian families with dependent children. One in four single parent families live in poverty. The consequences of material and social deprivation for children are foundational in early years, influencing cognitive development, developmental milestones, school achievement and future employment opportunities. Analysis by housing tenure shows that the vast majority of people below the poverty line were in rental housing in 2014 (59.7%), with most in private rental housing (44.2%) compared with 11.4% in public housing. Only 15.5% of people living below the poverty line were home owners, with a slightly higher proportion being mortgagees than outright owners[39].

Poor housing affordability also erodes equity and living standards, especially those of private rental households with children that cannot cross the threshold into owner occupation, do not

benefit from housing security and asset wealth, and have poorer mental health than home owners and people with mortgages[40].

A 2015 review by the US Centre for Housing Policy Research[41] concluded that overall, the research supports the critical link between stable, decent, and affordable housing and positive health outcomes. The pathways identified for this linkage were:

- Affordable housing can improve health outcomes by freeing up family resources for nutritious food and health care expenditures, and for other necessities such as utility bills.
- Affordable housing can reduce stress and related adverse health outcomes by providing families with greater residential stability.
- Affordable homeownership may positively impact mental health, however unsustainable forms of homeownership may negatively impact health.
- Well-constructed and well-maintained affordable housing can reduce the health problems associated with poor-quality housing.
- Stable, affordable housing may improve health outcomes for individuals with chronic illnesses by providing an efficient platform for health care delivery.
- Access to neighbourhoods of opportunity can reduce stress, increase access to amenities, and lead to important health benefit.
- By alleviating crowding, affordable housing can reduce exposure to stressors and infectious disease.
- Environmentally efficient housing reduces environmental pollutants, lowers monthly energy costs, and improves home comfort and indoor environmental quality.
- Affordable and accessible housing linked to supportive services enables older adults and others with mobility limitations to remain in their homes.

Specific health impacts of housing affordability will now be examined.

Impact of housing affordability on mental health status

There are many causes of psychological distress, and multiple stressors can impact people's mental health. NSW Health uses the Kessler 10 scale for adults (aged over 15 years) to measure psychological distress. There is a strong association between high Kessler scale scores and incidence of mental health problems. In 2013 approximately one in ten (9.1%) residents in the City of Sydney Local Government Area were estimated to experience psychological distress[42].

As noted above, the research indicates that affordable housing can reduce stress and related adverse health outcomes by providing families with greater residential stability; and that affordable home ownership may positively impact mental health though unsustainable forms of home ownership may negatively impact health[41].

People living in affordable housing have significantly better average mental health than those living in unaffordable housing[43]. One of the few Australian studies that looks directly at the causal relationship between housing affordability and health uses both cross sectional and longitudinal data to examine this relationship[43]. Among HILDA study participants - a representative sample of Australian households, across each age, sex, and income group, people whose housing had become unaffordable had worse mental health than people whose housing had remained affordable. People who had moved from one house to another had a lower average mental health (MCS) score than people who had not moved between waves, and if their housing had also become unaffordable, their average MCS score was the lowest observed. Housing becoming unaffordable was more likely for people in the lowest 40% of the income distribution and for those who had moved. The study found that health differences could be related to people with poorer mental and/or physical health being more likely to live in unaffordable housing. In addition, people whose housing became unaffordable experienced a decline in their mental health scores in the short term, though it was unclear what the long term impacts may be. This impact is observed particularly for low to moderate income households, with a smaller effect on higher income households.

Overseas studies confirm the relationship between housing insecurity, housing stress, and poor mental health status. A large-scale Canadian study found a gradient in mental health status by housing tenure, even after controlling for demographic variables such as age, gender, marital status and education levels[44]. Home owners without mortgages reported less psychological distress than home owners with mortgages, who in turn reported less distress than renters. Similarly, a large-scale British study analysing the relationship between unsustainable housing commitments and mental health found that housing payment problems and entering arrears had significant psychological costs, above and beyond the financial aspect and similar to those experienced as a result of life events such as marital breakdown or unemployment. The authors concluded that threats to housing represented a major life event affecting mental health[45]. Similar findings occurred in a qualitative UK study on the health consequences of mortgage possession, in which families describe the sense of loss as equal to losing a loved one or part of themselves[46].

Chronic, everyday stress including stress related to housing issues, can adversely affect health and wellbeing, and may be more difficult to address than stress associated with significant life events[47]. Stressors can also have widespread repercussions, with responses to the stress creating further stressful circumstances for the self and others. For example, the anxiety and stress associated with a lack of permanent, affordable housing may contribute to child neglect, with children in turn becoming depressed, aggressive or difficult for parents to handle[48].

Research into the mental health status associated with different tenure types indicates that home owners have the highest mental health status, followed by private renters. Public renters have the poorest mental health on average. This may be due to underlying differences in the populations which enter these tenure types, and may also be compounded by the tenure type itself. Not only does the population of renters have a worse average mental health score than people who are paying off a mortgage on their own home, if housing affordability for a renter worsens, they are also more likely than owners to experience a decline in their mental health as a result[49, 50].

Housing insecurity is a by-product of unaffordability, as renters lack power in the market, and housing insecurity can increase stress and have negative impacts on mental health. A recent report based on a survey of more than 1,000 private renters found that Australia lacks many of the protections that countries with a high proportion of renters afford to renters. There is a significant power imbalance between landlords and tenants, and a high proportion of tenants felt they were discriminated against and live in a climate of fear. Key findings included that the vast majority (83%) of tenants have no fixed-term lease or leases less than 12 months long; that the median rent price is Sydney and Melbourne is $480 per week, well above the national average; that half of tenants feel they are discriminated against in rental applications, usually because they received government payments, or because they had young children, pets or were a single parent; and 5% felt discriminated against because of a disability. The report calls for a national plan to boost housing supply, particularly affordable housing, and address tenants' security, rights and amenity[51].

Impacts of housing affordability on access to housing close to workplaces

There is strong evidence that employment status is an important determinant of health status. Employment is beneficial for health, particularly for depression and general mental health [52]. Many research studies have confirmed the link between poor health outcomes and unemployment, with the literature indicating that the health effects of unemployment could be induced by socio-economic factors, such as financial strain and poverty; and that

individual risk factors, such as lack of exercise, alcohol abuse and smoking, can substantially contribute to the increased relative mortality risk associated with unemployment[53].

As noted earlier, lower paid “key workers” in sectors such as emergency services, education, health care, retail, and hospitality, who live and work in inner city areas experience significant housing affordability problems[31, 32].

There are fewer than 700 inner-city community rental properties available for key workers. Yet there were an estimated 47,000 essential public and private sector staff working in the City of Sydney in 2011. Essential workers are also unable to access social housing, which is now being allocated only to the most disadvantaged members of the community. While social housing supply is above the City’s 2030 target of 7.5 per cent of all dwellings, there were 59,500 households on the waiting list across the state in 2014[54].

The impact of housing affordability on key workers has far-reaching implications. A lack of appropriate affordable housing means many workers pay a high proportion of their incomes in housing to live near employment; travel longer distances in order to work in their chosen location, increasing transport costs and reducing disposable income and time available with family and recreation; seek employment in a different location closer to where they can afford to live; or seek employment in a different sector [32]. Key workers on lower incomes may also postpone increasing family size or to avoid having a family altogether, owing to the lack of suitable affordable housing available to them.

A study by AHURI of housing affordability and low income workers found the volume of jobs in central cities was not matched by the number of potential workers, and there was less availability of low income workers to work in some areas such as hospitality, retail, support services, travel and recruitment agencies, and heath and service sectors including home care and child care. Lower income workers who worked in the central city area were more likely than non-metro workers to rent; live with unrelated strangers or extended family; live in an apartment; compromise size of bedroom and number of occupants; or live further from where they work[55].

Lower income and less wealthy households are increasingly being forced to outer suburbs, and inner urban areas are becoming “enclaves of wealthy owner occupiers and young, relatively affluent renters”[56]. The consequence is a spatially polarised city, which has implications for the longer term employment retention of key workers.

As a result inner city areas may face shortages of lower income workers in key sectors as these workers are unable and unwilling to bear the financial and social cost of long distance commutes, illustrating that housing stress can have far-reaching implications not only for those experiencing the stress, but more broadly for our society and economy. Employers may find it increasingly difficult to fill employment vacancies and staff shifts, hampering business productivity and economic growth, and impacting on broader community health and wellbeing if there are workforce shortages in areas such as health, aged care, education, and child care[55].

From the point of view of the workers themselves, long commutes take time from families, social lives and community participation. Lengthy commutes also burn fossil fuels, produce air pollution, and congest roads. On the other hand, the provision of adequate affordable housing for key workers in inner city communities can create stability, engagement, and a sense of community, by ensuring that the people who make the community work can live near their jobs and become part of the social fabric. Affordable housing can also enable families to remain in their community even when they experience temporary job loss, a disruption to the family, or an illness or other crisis.

Physical health impacts of access to affordable housing of acceptable quality

There is evidence that well-constructed and well-maintained affordable housing can reduce the health problems associated with poor-quality housing; and that by alleviating crowding, affordable housing can reduce exposure to stressors and infectious disease[41]. It is therefore of concern that housing stress means many individuals and families are forced to live in sub-standard or overcrowded housing.

A number of studies have shown strong associations between housing characteristics and several diseases. Marsh et al., [57] identified the main issues as: overcrowding, associated with infectious and respiratory diseases; damp and mould, associated with respiratory disease, eczema, asthma and rhinitis; indoor pollutants and infestation, associated with asthma; and exposure to low/cold temperatures, associated with respiratory infection, hypothermia, bronchospasm, and heart disease. More broadly, aspects of housing that have been empirically identified as influencing physical health include environmental allergens, toxicants, cleanliness, housing disrepair and safety, building height and opportunities for outdoor play, crowding, housing affordability, home ownership, frequent residential moves, homelessness, and neighbourhoods[57].

An AHURI study[35] examined the literature on the relationship between housing and health, and concluded that poor housing has a clear negative impact on residents' health, although the illnesses tend not to be among the most serious. The most significant impacts result from cold, dampness and mould. The study found that poorly designed housing predisposes accidents such as falls and burns, with children and the elderly being particularly affected.

A recent survey of private renters in Australia found that many tenants live in unsafe and unfit homes but are too worried about being evicted to complain. Of those surveyed, 21% of tenants waited at least a week to hear back about urgent repairs; 11% had a rent increase after asking for repairs; and 14% were too scared to complain about something or ask for repairs. The most common problems with rental properties were found to be pests; doors or windows that did not close property; peeling paint or tiles coming off; leaks or flooding; and persistent mould[51].

Vulnerable groups such as the sick, the elderly, and the unemployed are among those most likely to live in poor housing and also tend to spend long periods of time indoors exposed to potentially hazardous environments[35].

Health impacts of access to social infrastructure and amenity

There is evidence that access to "neighbourhoods of opportunity" can reduce stress, increase access to amenities, and lead to important health benefits. Furthermore, stable, affordable housing may improve health outcomes for individuals with chronic illnesses by providing an efficient platform for health care delivery; and affordable and accessible housing linked to supportive services enables older adults and others with mobility limitations to remain in their homes[41].

A shortage of affordable housing limits families' and individuals' choices about where they live, often relegating lower-income families to substandard housing in unsafe, overcrowded neighbourhoods with higher rates of poverty and fewer resources for health promoting activity (such as parks, bike paths, recreation centres and activities[41].

An area that has had limited focus to date is the relationship between housing, loneliness and health. Franklin and Tranter[58] cite evidence of the health impacts of loneliness, including that loneliness is directly associated with Alzheimer's disease, obesity, increased vascular resistance, elevated blood pressure, increased hypothalamic pituitary adrenocortical activity, sleep disorders, diminished immunity, reduction in independent living, alcoholism, depression, suicidal ideation and behaviour, mortality in older adults, elevated cholesterol

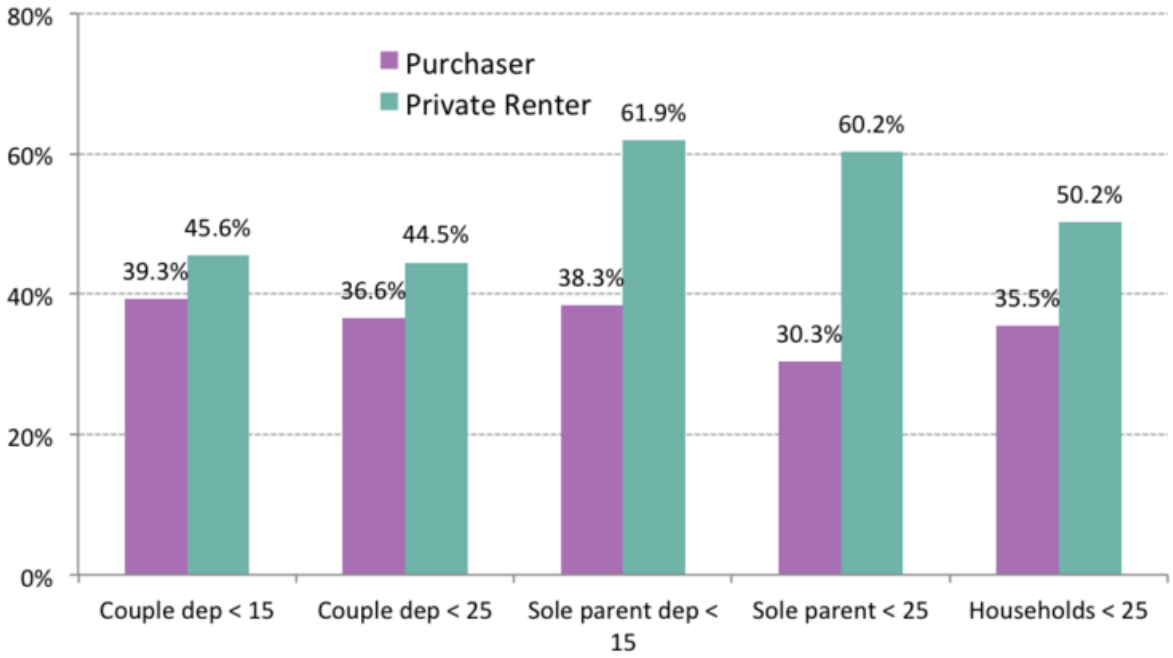
and blood pressure in later life among adolescents. Loneliness is also negatively to life satisfaction, to subjective well-being, to higher levels of psychological distress and low levels of psychological wellness. Lonely people are four times more likely than others to have a heart attack, and four times more likely to die from it. Lonely people use emergency services 60 per cent more often than the non-lonely and as elderly people are twice as likely to be admitted into nursing homes. Access to social infrastructure and amenities that address social isolation is an important factor in population health[58].

To promote economic and social diversity, communities need to include a range of family structures and people at different life stages. Communities where housing is unaffordable lack such diversity and vibrancy.

Health impacts of housing affordability in relation to household expenditures

The literature indicates that affordable housing can improve health outcomes by freeing up family resources for other expenditures that impact on health, such nutritious food and health care expenditures, and for other necessities such as utility bills[41]. The City of Sydney Community Wellbeing indicators reveal that eight percent of residents experiencing food insecurity – "ran out of food and could not afford to buy more"[42].

The Australian Bureau of Statistics' (ABS) *Household Expenditure Survey* indicates that the proportion of average weekly household expenditure allocated to housing increased from approximately 12.8% in 1984 to 18.0% in 2009–10, partly as a consequence of rising house prices [3].For low income families with children, and particularly for single parent households and those in rental housing, housing absorbs a much higher percentage of the family budget, as illustrated by the graph below.



Housing costs as a percentage of disposable income among lower-income families [59]. The City of Sydney Community Wellbeing Indicators reveal that eight percent of residents experiencing food insecurity – 'ran out of food and could not afford to buy more' [42].

Significant research has been conducted on the relationship between a lack of affordable housing and the ability of lower income families to meet other essential expenses. The research indicates that this constant and tremendous financial strain places forces many families to make trade-offs between food, heating and other basic needs. High housing payments relative to income, along with rising utility costs, force some families to choose between heating, eating, and filling prescriptions. One study found that low-income people with difficulty paying rent, mortgage or utility bills were less likely to have a usual source of medical care and were more likely to postpone treatment and to use the emergency room for treatment [60]. Other research in the US has found that the trade-offs made by families spending large proportions of their income on housing included reduced expenditure on food, medical insurance, and health care, threatening the health of all family members, but particularly children. This was particularly true for low-income households spending more than half of their income on housing. The research also indicates that increases in average rents are correlated with increased food insecurity for children. Children in low-income families that received housing assistance were found to be more likely to meet "well child" criteria including the absence of developmental concerns and maintenance of a healthy weight [41].

Impact of housing affordability on healthy child development

The built environment can have both positive and negative effects on healthy child development, and the design and implementation of healthy built environments in which young children can live, grow, and develop, has implications for health and well-being throughout the life course. Development in the early years, particularly the first three years, lays the foundations and sets the trajectory for children's ongoing physical, social, emotional, and cognitive development[61]. It is therefore critical to set optimal child trajectories early in childhood, and address developmental vulnerabilities in children.

There are strong links between housing suitability, stability, and affordability, and healthy child development. Factors shaping child development and well-being are complex, often interrelated and frequently multiplied by coincident factors. Consequently, housing can impact on children's development and well-being through both direct and indirect mechanisms. For example, inability to afford appropriate housing is linked to frequent moves, shared housing with other families, overcrowding or even homelessness. As noted above, housing stress can also impact on children's access to healthy food and health care, significantly impacting on healthy development.

The 2013-14 Australian Bureau of Statistics *Survey of Income and Housing Data* confirms that home ownership is out of reach for many families with children and that housing costs – either mortgage or rent – can be crippling[62]. Of lower-income two-parent families with dependent children aged under 15 who are buying their home, 39% face unaffordable mortgage costs. More than 60% of lower-income, single-parent households with children aged under 15 pay unaffordable rent. Close to half of two-parent families are in similar housing stress.

Dockery et al[63], examined the relationship between housing and development outcomes for children. Some of these links are irreversible and continue into adulthood. The authors noted that housing stress is particularly prevalent among households with children in Australia; children make up a significant proportion of the homeless in Australia; and the housing experiences of Indigenous children are significantly worse than those experienced by non-Indigenous children.

A number of studies indicate poor housing in childhood can have an impact on health in later life, even when housing conditions in later life improve. The main areas where poor housing conditions can impact on child health include increased risk of infectious and respiratory diseases where there is overcrowding; increased risk for respiratory diseases, eczema,

asthma and rhinitis where there is damp and mould; increased risk for asthmas as a result of Indoor pollutants or infestation; and increased risk of respiratory infections, hypothermia, bronchospasm and heart disease due to inadequate heating/low temperatures. In addition, if housing stress results in homelessness, risk for a range of physical ailments is increased[35].

It has been shown that children who live in areas with higher rates of unaffordable housing tended to have worse health, more behavioural problems and lower school performance[64]. Families who lack affordable housing are more likely to move frequently. Residential instability is associated with emotional, behavioural and academic problems among children, and with increased risk of teen pregnancy, early drug use, and depression during adolescence[65, 66]. These impacts can in turn have longer-term health consequences.

Lack of access to affordable housing has considerable implications for child poverty, and living in poverty has major implications for healthy child development. In addition to the physical health impacts of poor housing on children, as outlined above, poverty in the early years influences social behaviour: both positive and problem behaviour. The mechanisms by which low-income environments affect early development are proposed as complex interactions of biological and environmental influences, influencing human relationships; physical, chemical and built environments; and nutrition. Together these interact with genes to produce biological “memories” with long-term consequences for adaptive behaviour and responses to stress[67].

Nearly one in five (17.4%) of all children in Australia are living in poverty, and since 2012, the poverty rate for children in lone parent families has increased from 36.8 to 40.6%. Lone parents experience a higher risk of poverty due in part to lower levels of employment. The responsibilities of being the lone parent of a child can severely restrict choices and options for lone parents[39].

Poverty or low family income, including unaffordable housing during the first five years of life is more deleterious for intellectual development than is poverty later in childhood or adolescence[41].

Key drivers of childhood poverty include the location and costs of housing, and the increasing insecurity of housing for many low-income households. Tenure insecurity and housing stress are part of a larger picture of housing disadvantage for many Australian families with dependent children.

The vast majority of people below the poverty line are in rental housing (59.7%), with most in private rental housing (44.2%). Only 15.5% of people living below the poverty line were home-owners. Those most at risk are children in lone parent families, who are more than three times likely to be living in poverty (40.6%) than those from couple families (12.5%)[39].

Impact of housing affordability on homelessness and health

On any given night over 100,000 Australians are without a home[68]. While domestic and family violence is the reason 24% of people (mainly women, accompanied by children under 12) present at specialist homelessness services, 15% present due to financial difficulties, and 16% due to the housing crisis. Fundamentally, each of these reasons for homelessness results from the people lacking access to safe, securely tenured, affordable and well located housing. The capacity of services to meet the demand is limited by their ability to secure public housing, community housing, or affordable rental properties in the private rental market. The availability of safe, secure and affordable housing is critical to transitioning clients out of homelessness and preventing future homelessness[69]. The vulnerability index of rough sleepers in the City of Sydney showed that housing affordability was the number one cause of rough sleeping in 2016[70].

Homeless people experience a wide range of illnesses and injuries to an extent that is much greater than that experienced by the population as a whole. First of all, health problems themselves, directly or indirectly, may cause or contribute to a person's becoming or remaining homeless. The leading example is major mental illness, especially schizophrenia, in the absence of treatment facilities and supportive housing arrangements. Second, the condition of homelessness and the exigencies of life of a homeless person may cause and exacerbate a wide range of health problems. Just as ill health can cause homelessness, so can homelessness cause ill health. Examples of this include skin disorders and the sequelae of a traumatic injury. Finally, the state of being homeless makes the treatment and management of most illnesses more difficult even if services are available. Examples of this can be found for alcoholism and nearly any chronic illness, such as diabetes or hypertension[71].

Summary of potential key health impacts of housing affordability

Potential impacts of housing affordability	Nature of impact	Consequence and severity of impact	Populations impacted
Impacts on mental health status.	Affordable housing can reduce stress and related adverse health outcomes and may positively impact mental health. People living in affordable housing have significantly better average mental health than those living in unaffordable housing.	Evidence for causality and for severity of long term impact is limited.	Particular impact on people on low to moderate incomes (those in the lowest two income quartiles). Impact is highest on renters. Home owners have the highest mental health status, followed by private renters. Public renters have the poorest mental health on average.
Lack of affordable access to housing close to workplaces for lower paid "key workers" in sectors such as emergency services, education, health care, retail, and hospitality.	Lower paid workers may cease living and working in the area, impacting on health and care services for the inner urban community. Alternatively they may live in the community at high cost, or live elsewhere and commute long distances, with impacts on their own health and wellbeing.	Potential shortages of key workers in sectors such as health, aged care, education, and child care has implications for the health and wellbeing of the inner urban community. Conversely, those who continue to work in inner urban areas will experience impacts to their own financial wellbeing and time available for health promoting activities.	Particular impact on workers on low to moderate incomes (those in the lowest two income quartiles). The general population in inner urban areas may be impacted by a shortage of key workers to provide health and care services in their community.
Lack of access to affordable housing of adequate quality, leading to accommodation in poor quality housing, and/or overcrowding.	The literature establishes a link between poor quality housing and poor health status, but there is a lack of clear evidence to demonstrate a causal effect between housing affordability as such, and physical health status.	Poor housing has a clear negative impact on health, with the most significant impacts resulting from cold, dampness and mould; as well as accidents such as falls and burns. Overcrowding can increase exposure to stressors and infectious disease.	People on low to moderate incomes. Vulnerable groups such as the sick, the elderly, and the unemployed are most likely to live in poor housing. Children and the elderly are particularly affected by accidents arising from poorly designed housing.
Health impacts of access to social	Access to social infrastructure and	Poor access to social infrastructure	Low to moderate income households

infrastructure.	amenity builds community connections and addresses social isolation. Stable, affordable housing linked to health care and social services can improve health status and enabling older adults and others with mobility limitations to remain in their homes. However, low-income households are often unable to afford to live in areas with good social infrastructure, and instead live in areas with higher rates of poverty and fewer resources for health promoting activity.	can lead to social isolation and loneliness, increasing risk for a wide range of diseases and for mental health and substance misuse problems; as well as leading to a reduction in independent living, and higher rates of admission to nursing homes amongst elderly people.	unable to afford housing in neighbourhoods with good social infrastructure.
Health impacts of the proportion of household budgets spent on housing.	Affordable housing can improve health outcomes by freeing up family resources for other expenditures that impact on health, such as nutritious food and health care expenditures, and other necessities such as utility bills.	Many families must make trade-offs between food, heating and other basic needs, including access to medical care and pharmaceuticals. This has significant implications for the health of family members.	Low to moderate income households, particularly low income families with children, and single parent households and those in rental housing.
Impact of housing affordability on healthy child development.	Children who live in areas with higher rates of unaffordable housing tended to have worse health, more behavioural problems and lower school performance. Poverty in childhood is impacted by housing unaffordability and has significant long term health consequences. Poor housing and housing stress in childhood can have an impact on health in later life, even when housing conditions in later life improve.	Lack of access to quality, affordable housing can increase children's risk of infectious and respiratory diseases including eczema, asthma and rhinitis, hypothermia, bronchospasm and heart disease. If housing stress results in homelessness, risk for a range of physical ailments is increased.	Low to moderate income families with children, and particularly families with children who are living in poverty. The vast majority of people below the poverty line are in rental housing, particularly private rental housing. Those most at risk are children in lone parent families, and Indigenous Australian children.
Impacts of housing	Homelessness	Homeless people	Over 100,000

affordability on homelessness and health.	ultimately results from people lacking access to safe, securely tenured, affordable and well located housing. In situations where housing is less affordable, more people are likely to be exposed to the risk of homelessness.	experience a wide range of illnesses and injuries to an extent that is much greater than that experienced by the population as a whole, including mental illness; skin disorders; the sequelae of traumatic injury; alcoholism; and chronic illnesses such as diabetes or hypertension.	Australians are without a home on any given night.

Implications for Green Square development

The literature review undertaken for this report has shown that housing affordability has key impacts on health, particularly in the following areas:

- Affordable housing can reduce stress and related adverse health outcomes. People living in affordable housing have significantly better average mental health than those living in unaffordable housing. Housing unaffordability and insecurity is correlated with worse mental health.
- Lack of access to affordable housing close to inner urban workplaces impacts on the ability of lower paid “key workers” to live close to their work. These workers may consequently either live close to their jobs, paying unaffordable housing costs and sometimes living in crowded conditions, or commute long distances to work; either choice has potential negative impacts on their health and wellbeing. Alternatively, they may choose to live and work elsewhere, potentially leaving inner urban communities with workforce shortages in key areas such as health, education, and aged care, impacting on the health and wellbeing of the inner urban community.
- Lack of access to affordable, adequate quality housing can lead to people living in poor quality housing; this particularly applies to vulnerable groups such as the sick, the elderly, and the unemployed. Poor quality housing has a clear negative impact on health.
- Access to social infrastructure and amenities that address social isolation is an important factor in population health. A shortage of affordable housing can relegate lower-income families to unsafe, overcrowded neighbourhoods with higher rates of poverty and fewer resources for health promoting activity. Stable, affordable housing can improve health outcomes for individuals with chronic illnesses and enable older adults and others with mobility limitations to remain in their homes. Conversely,

social isolation and loneliness can increase risk for a wide range of chronic and acute diseases and impact negatively on independent living.

- The proportion of household budgets spent on housing impacts on the family resources for other expenditures that impact on health, such as nutritious food and health care expenditures, and other necessities such as utility bills. Where families must make trade-offs between food, heating and other basic needs, including access to medical care and pharmaceuticals, there are significant implications for the health of family members.
- Housing stress and related poverty has very significant implications for healthy child development and for health in later life. The impacts span physical and mental health, and behavioural development.
- Lack of housing affordability is a key driver in homelessness, with over 100,000 Australians homeless on any given night. Homeless people experience a wide range of illnesses and injuries to an extent that is much greater than that experienced by the population as a whole, either as a cause or effect of homelessness.

The City of Sydney has already identified several strategies that will be key to ensuring an acceptable level of housing affordability and security for residents of the City:

- Policy reforms are needed to address declining housing affordability and rental security.
- The affordable rental housing supply needs to grow significantly to ensure Sydney's social and economic sustainability.
- A sustainable model needs to be developed for social housing supply as a vital form of social infrastructure.
- Investment to expand innovative housing models is critical to ending homelessness.
- Housing and infrastructure delivery need to be integrated through Sydney metropolitan planning for sustainable growth [54].

These strategies are all pertinent to the Green Square development, where the delivery of affordable housing will be a major challenge. The City's Southern Employment Lands affordable housing levy requires that all developments in the "Employment Land" such as Green Square, make a contribution towards affordable housing[72].

This allowed "*The consent authority to collect affordable housing contributions through the development of Green Square, in order to maintain social diversity as the area undergoes renewal"* [73 p26]. The scheme allows the City of Sydney Council to collect contributions either

by making a monetary contribution to the Recommended Community housing Provider, who will provide units on other sites around or in Green Square or by way of dedicating affordable housing units on site[73]. The proposal is to develop 300+ affordable housing units through City-owned residual land south of Green Square.

To deliver on the targets set out in *Sustainable Sydney 2030,* the *Green Square Affordable Housing Scheme*[73] applies a levy to all development for the purpose of providing affordable housing. The legislative basis for the levy is the *Affordable Rental Housing SEPP* (as outlined earlier in this paper), which requires the Sydney Local Government Area to address the need for affordable housing. The Sydney Local Environmental Plan (LEP) 2012 provides that 3 per cent of residential and 1 per cent of non-residential floor space of development make a contribution to affordable housing. Under the *Green Square Affordable Housing Scheme,* this contribution can be made in kind, where finished affordable housing units are dedicated to the eligible community housing providers; or by a monetary contribution which is passed on to the community housing provider to build affordable housing. To date, only monetary contributions have been made under the Scheme. The Scheme will deliver 330 units through City-owned residual land south of Green Square, with 206 completed or commenced by early 2015. This will fall well short of the approximately 2,000 affordable housing dwellings required to be delivered in the urban renewal area if the 7.5% LGA target is to be achieved. Additional approaches to the delivery of affordable housing are being investigated[20 p82-83].

Note that estimates provided by the community housing provider put the potential number of affordable dwellings available within a five year timeframe at perhaps 450 dwellings, including the 200 already built. The community housing provider confirms that additional planning strategies are likely to be needed to achieve the City's affordable housing targets; suggestions for potential strategies include the release of Government land and/or increasing the affordable housing requirements in terms of floor space ratio.

It appears that the current strategies being implemented under the *Green Square Affordable Housing Scheme,* in the context of the *Affordable Rental Housing SEPP,* will result in only 1-2% of dwellings in Green Square being affordable housing. Lack of affordable housing will have major health impacts, as outlined above. It could be expected that key impacts for Green Square and for the City of Sydney could include a shortage of key workers in critical sectors, as housing costs make it difficult for low to moderate paid workers to remain in the area; and severe housing stress for low and moderate income workers and households who

remain in the area, impacting on physical and mental health throughout the life course, and leading to increased overcrowding and homelessness[74].

Options that could be considered to increase the amount of affordable housing available in Green Square might include donation of land from Council, state government or developers; institutional investment; negotiation with developers to increase the provision of affordable housing; or increases in the Floor Space Ratio. It is also timely to consider whether it would be prudent to disallow the option for developers to provide affordable housing cash payment in lieu of providing actual dwellings. It is notable that developers have universally chosen to provide cash payments rather than dwellings, yet the rapid increase in property prices in Sydney quickly erodes the value of such payments. Developing realistic additional strategies to address housing affordability in the Green Square development will help to reduce the significant negative health impacts of housing unaffordability both on residents in the area and on those forced to leave the area.

APPENDIX 2.1: DECLINING HOUSING AFFORDABILITY – CAUSES AND IMPACTS

Housing affordability in Australia has broadly declined since the early 1980s. The OECD's price to income ratio index shows a 78% increase between 1980 and 2015. In Sydney, which has experienced significant price rises over the period, calculations indicate that the ratio of average disposable household income (Australia-wide) to median house prices has increased from approximately 3.3 in June 1981, to just over seven in June 2015 [3].

Housing affordability is a major and growing political, economic, health and social policy issue for metropolitan Sydney. The international consultancy Demographia undertakes an annual International Housing Affordability Survey which generates considerable media and public interest. The 13th annual survey, undertaken in 2016 and published in January 2017, again ranks Sydney as second only to Hong Kong in housing unaffordability amongst the 406 metropolitan housing markets surveyed [75].

Rising property prices in Sydney have resulted in decreased home ownership, increased renting and greater housing stress for people with mortgages and for renters. Factors contributing to property price growth in Sydney include:

- Higher average incomes for some groups and an increase in the number of double income households (note that real wages have increased the least for lower paid workers, resulting in greater income inequality);
- A decrease in the size of the average household due to later marriage, fewer children and increased incidence of separation and divorce;
- Relatively strong population growth underpinned by higher immigration rates;
- The decline in standard home loan interest rates from the mid-1990s to present, reflecting a low inflation environment;
- Greater availability of credit, including from non-bank lenders;
- Taxation system incentives which have encouraged investment in second and third properties (through negative gearing provisions and the 50 per cent capital gains tax discount) and have benefited owner-occupiers over renters (through the capital gains and land tax exemptions on owner-occupied housing)[27].

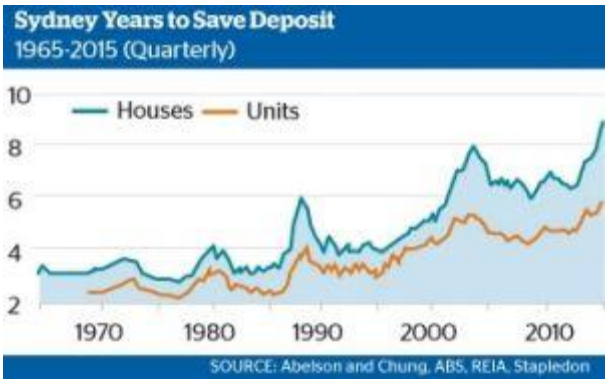
Rapid property price growth, not matched by income growth, is resulting in lower levels of home ownership, higher levels of renting, and more people retiring without owning their home, putting them at higher risk of financial stress and housing insecurity. In 2016, 29 per cent of Australian households owned their home, down from 33 per cent in 2008[22].

Table A2.1: Home ownership and renting in Australia and NSW 2011

Ownership and renting	Australia	NSW
Owned: outright	15.7%	32.2%
Owned: with a mortgage	13.4%	32.3%
Rented: Private rental	65.7%	31.8%
Rented: State housing	1%	0.9%
Other tenure type	4.2%	2.8%

Source: [22]

Would-be home buyers are spending more time saving the deposit to purchase a property and spend longer in the rental market. In Sydney, couples spent an average of 8.4 years raising the $214,600 required for a deposit on a median-priced house (Bankwest's first time buyers report December 2016). If and when they do purchase, they have larger mortgages, putting them at higher risk of future housing stress when interest rates move from their current lows.



Source: [76]

Housing stress in Australia is increasing over time. The proportion of households paying more than 30 per cent of income in mortgage costs doubled between 1982 and 2011, and housing affordability has deteriorated further since. Housing stress increased more among renters, particularly since 2007, with over a third of renters in housing stress. The rate is higher among middle and low income earners [76].

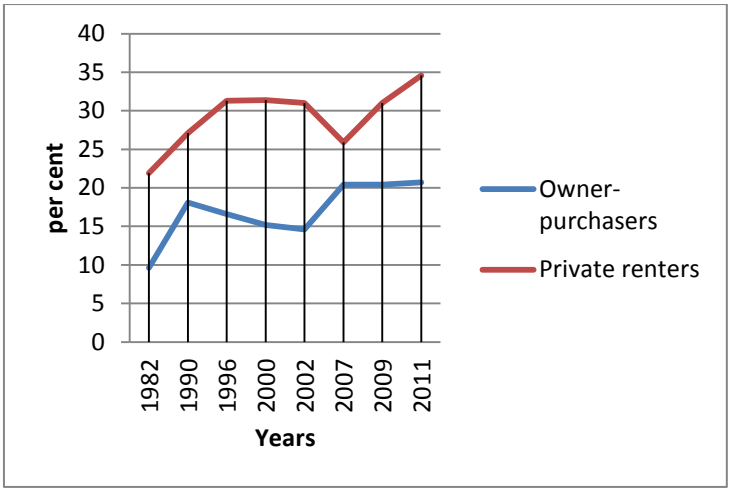


Figure A1: Per cent of households in Australia with gross housing cost exceeding 30 per cent of the gross household income, by household tenure, 1982-2011. Source: [76]

Sydney has Australia's most expensive housing market, and for people living within the City of Sydney, housing stress is extreme. The City of Sydney Community Wellbeing Indicators Report highlights the proportion of households experiencing housing stress within the Council area. There are three measures for housing stress outlined which increased for all groups between 2006 and 2011.

Table A2.2: Housing stress by household income level - City of Sydney LGA 2006 and 2011 and Greater Sydney 2011

	City of Sydney		Sydney CCSA Average
	2006	2011	
Proportion of ***all*** households that are renting or mortgaged, which are in housing stress	38.9%	42.1%	42.7%
Proportion of ***all*** households that are renting or mortgaged, in housing stress ***and*** on a very-low to moderate household income*	25.9%	26.1%	---
Proportion of ***only*** very-low to moderate income households* that are in housing stress.	80.0%	83.6%	84.1%

Source:[28].

Rising property prices in Sydney have resulted in decreased home ownership, increased renting and greater housing stress for people with mortgages and for renters. In 2011, 25% of homeowners and 42% of renters in the City of Sydney LGA spent over 30% of household income on housing. The proportion of very low income residents experiencing housing stress

was 84%. Evidence is also emerging of people living in overcrowded and poor quality housing. The lack of alternatives to market housing is worsening this situation[54]. Even those on moderate incomes are susceptible to housing stress. In 2013–14, half the population with income levels of up to $120,900 for a couple with two children were experiencing housing stress[62].

In the City of Sydney, gentrification of inner city neighbourhoods has exacerbated housing inequality. The market is becoming virtually inaccessible to those on very low to moderate incomes, including essential workers who are increasingly being forced out of the City, relocating to outer suburbs and commuting further distances to employment. The effect is increasingly divided communities. There is a dimension of generational inequality, as younger people (typically first home buyers) are priced out of the market[13].

The increasing cost of housing in Sydney has forced many people to rent apartments, which are more affordable than houses. Yet there is an inadequate supply of budget friendly residences that are appropriate for a range of family structures. This mismatch is a threat to community diversity and community health. With an estimated 1.6 million more people living in Sydney by 2036 addressing the health and social consequences of housing affordability for medium and lower income earners is an increasingly urgent issue.

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Appendix 3. Urban Transport Assessment Report

The significance of urban transport systems

This assessment report examines available evidence relating to the health impacts of urban transport, with reference to active, public and private transport modes and related connectivity issues. It aims to inform planning for the City of Sydney Green Square development.

This report will present evidence indicating that to achieve positive health impacts, urban planning and the urban transport system must encourage uptake of active and public transport, and discourage private vehicle use. Built environments and effective transport systems which promote higher levels of active and public transport and provide connectivity, contribute to a healthy community by improving people's health through greater physical activity; improving road safety and reducing road accidents; reducing the health impacts of traffic congestion and related air pollution; improving the sense of community safety as more people are visible on streets and paths; and reducing residents' costs of living if they do not need to own and run private vehicles, freeing up household resources and promoting wellbeing.

Cities with sustainable transport systems address environmental, economic and social issues through partnerships between communities, governments and developers, at national, regional and local levels. City health impact assessments are part of the process, and highlight the benefits of walking and cycling as alternatives to vehicle usage, and the importance of public transport including as a social service. It is notable that trends towards urban consolidation often receive favour in public transport circles, but do not necessarily align with social aspirations nor represent efficient outcomes for all. In particular, despite the best intentions of transport planners, in Australian the growth of vehicle use has overtaken all other travel trends, leading to a significant consequential cost of urban congestion[1].

Delivering a health-promoting urban transport system, which discourages private vehicle use and encourages uptake of active travel and public transport, requires attention not only to transport policy itself, but to a range of urban planning policies and regulations. A growing body of evidence indicates that the shape of a neighbourhood has a direct impact on its residents' health, not only

physical health, but also mental health and child development[2-4]. The form of the built environment, including residential and commercial density, land use mix, connectivity and accessibility, influences the way we move and what we do within that environment. In particular, the built environment shapes our transport options, choices, and travel behaviour [4] including the quantity of walking, cycling, public transport and car travel people engage in, as well as the amount of leisure time that is available for other healthy pursuits[2, 4-6].

Evidence indicates that the localities most conducive to good health are characterised by mixed land use, open space, and good built design including identifiable centres. Higher density areas coursed with public transport and with well-connected streets, mixed use facilities, accessible services, and safe paths and open space have the potential to increase walking and cycling and reduce private vehicle use compared to low residential density neighbourhoods and neighbourhoods which lack these features [4].

Urban planning and transport policies which encourage uptake of active and public transport, and discourage private vehicle use, will therefore have significant implications for the health of residents of Green Square.

Policy context

Global policy context

The International Transport Forum (ITF) is an intergovernmental organisation with 57 member countries. It acts as a strategic think tank for transport policy and organises an annual summit of ministers, to help foster a deeper understanding among policy makers of the role of transport as a key to economic growth and to the pursuit of environmental and social sustainability. The ITF is part of the Organisation of Economic Cooperation and Development (OECD) family of organisations. Australia is a founding member of the ITF. The ITF has undertaken research and developed policy recommendations across a very wide range of topics, including public and active transport[7].

The World Health Organisation (WHO) acknowledges the impact of urban transport on population health, and has produced a key resource, Sustainable Transport: A Sourcebook for Policy-Makers in Developing Cities[8]. Based on international research, the WHO concludes that promotion of walking and cycling, and good access to public transport is associated with greater physical activity, opportunities to access essential goods, services and other requirements for health and well-being without increasing greenhouse gas emissions, greater opportunities for social interaction, and equity for low-income groups who lack access to a car. Conversely, car use is not only less active

but also poses hazards to other travellers, and moderating these hazards is especially important in cities with high population density and more vulnerable road users such as walkers and cyclists. A key goal outlined is to reduce vehicle kilometres travelled, which can lower emissions of air pollutants and of noise, and is also associated with fewer road traffic injuries, although the WHO notes that mode shift from car use to walking and cycling needs to be accompanied by measures to improve safety for users of these vulnerable modes. The document also outlines the importance of urban planning policies, noting that increased residential density has the potential to increase proximity to potential destinations, and thus improve access while reducing the need for private motorised transport. However, to maximise benefits, the WHO recommends that density of housing needs to be matched by increased density of key destinations such as health and social services, education and employment opportunities, transit nodes and green spaces. The WHO further notes that density can also bring people in closer proximity to the hazards of motorised transport, making it important that dense cities adopt measures to walkers and cyclists, and improving vehicle technology to reduce the emissions of air pollutants and noise per vehicle. Reducing these hazards can also remove safety barriers to walking and cycling, facilitating a shift to these healthy, climate-friendly modes.

National policy context

Urban transport policy and management in Australia has been largely a State and local government responsibility, with the Commonwealth having limited involvement. It has been recognised however by observers that the problems and challenges of urban transport are not just local in significance, but have important ramifications for national well-being, the environment and Australia's efficiency. These issues include transport efficiency and effects on economic growth, pollution and greenhouse gas emissions, health, and social amenity[1]. Nevertheless, Commonwealth involvement has been mainly indirect, through interventions relating to fuel, car and pollution taxes, rather than direct involvement in transport planning. The Federal focus has largely been on freight movement by road and rail, with urban roads supported through funding schemes and special projects [9]. It has been noted that there is potential for the Federal Government to become involved in urban transport planning, in a shared responsibility with the States, through pricing, regulatory and funding arrangements. These could include fuel taxes, pollution charges, new car fees and funding of public transport, as well as initiatives to facilitate interest in sustainable planning[1].

An Inter-Governmental Agreement on Regulatory and Operational Reform in Road, Rail, and Inter-Modal Transport was signed by all governments in 2003[10]. The objective of the agreement is to improve transport productivity, efficiency, safety, and environmental performance and regulatory

efficiency in a uniform or nationally consistent manner. In line with this agreement, the National Transport Commission (NTC) was established in 2003 with ongoing responsibility to develop, monitor and maintain uniform or nationally consistent regulatory and operational reforms relating to road, rail and intermodal transport. It performs the role of an expert adviser to the Transport and Infrastructure Council on national regulatory reform development, implementation and evaluation in the Australian land transport sector. The Commission appears to have a limited role in urban transport policy[11].

The Standing Council on Transport and Infrastructure (SCOTI) was established in 2011 to bring together Commonwealth, State, Territory and New Zealand Ministers with responsibility for transport and infrastructure issues, as well as the Australian Local Government Association. In December 2013, the Council of Australian Governments (COAG) agreed to a new Council System to better enable COAG to focus on, and progress, nationally significant reforms. The Transport and Infrastructure Council was established under these reforms, with similar membership to the former SCOTI[11]. Again the main focus appears to be on large scale longer distance transport, rather than urban transport.

In December 2013 Infrastructure Australia published a report titled *Urban Transport Strategy*[9]. Rather than being a nationally endorsed strategy, this is a report discussing the need for the development of a widely accepted, national framework for planning, financing and managing urban transport infrastructure, the lack of which is noted to have been an impediment to effective transport and city productivity. The report notes that debates in Australia about urban transport have tended to focus either on roads (especially car use) or public transport, emphasising local issues. Urban transport has not been viewed as an integrated system dealing with both people and freight flows. Key issues in urban transport identified in the report include: integrating transport systems; integrating long-term infrastructure planning and land-use planning; the impact of urban transport systems on productivity; the importance of urban access and equity; coherent and consistent funding and financing; and consistent measurement and reporting of results. The report does not explicitly discuss the health impacts of urban transport, but does briefly discuss “social considerations”, acknowledging that issues of access and equity are pertinent to discussions of urban transport. The report notes there is a direct link between low-income households and the need to travel greater distances in order to access services, activities, and employment; and that the benefits of enhancing accessibility, mobility, and encouraging economic participation of the “transport disadvantaged” can be particularly large. The report proposes a number of draft

principles to guide the development of an urban transport infrastructure strategy. The status of these recommendations is unclear.

The Australian Government Department of Health does not have an overarching policy framework for urban development and health. However, the Department funded the *Healthy Places and Spaces* initiative which was a national program between the Australian Local Government Association, the Planning Institute of Australia, and the Heart Foundation, for planning, designing and creating healthy built environments and sustainable communities[12]. The project produced a manual to guide professionals in the health, planning and property development industries, community groups, and governments in healthy urban design to help tackle some of Australia's major preventable health issues, particularly by encouraging walking, cycling, and the use of public transport[12].

The Australian Government also sponsors national *Physical Activity and Sedentary Behaviour Guidelines*[13]. The 2014 Guidelines continue earlier recommendations that children and young people should accumulate at least one hour of moderate to vigorous physical activity per day, and that adults should accumulate 2.5 to 5 hours moderate intensity or one quarter to 2.5 hours vigorous physical activity (or a combination of both) each week. New additional recommendations now also cover the need to reduce sedentary behaviour, and delineate the types of physical activity necessary to ensure good health[13].

The Australian Government's *Walking, Riding and Access to Public Transport* draft report explores how governments, businesses and the community can work together to encourage walking and cycling as part of an effective transport system in Australia, as a more sustainable, time efficient and cost effective alternative transport mode option for many short trips[14].

State of New South Wales and City of Sydney policy context

The NSW Government has indicated its appreciation of the relationship between built environments and health, acknowledging the strong evidence demonstrating the links between chronic disease and lifestyles characterised by car-dominated transport, reduced opportunities for exercise, increased fast food availability and lack of social connection; and developing strategies to address physical activity opportunities, healthy food access, and opportunities for social and community interactions[15]. Key policy documents developed by the NSW Government which are relevant to these issues include the *Healthy Urban Development Checklist* and the *NSW Healthy Eating and*

Active Living Strategy 2013-2018[15]*.* Active living was also promoted by the Premier's Council for Active Living, but this initiative was discontinued in 2016[16].

The NSW Government in December 2014 published *A Plan for Growing Sydney,* a new overarching strategic plan for Sydney for the next 20 years [17]. The strategy prioritises intensive development of several strategic locations within Sydney, including Green Square, with growth in these locations seen as critical to sustaining and expanding the economy and supporting more jobs closer to where people live[17].

The NSW Government's *NSW 2021* (2011), a 10-year plan, contains targets for improving transport services and shifting trips away from private vehicles towards public transport, walking and cycling[18] . It refers to Green Square as a particular target for growth supported by improvements in transport. The plan also calls for job growth in centres close to where people live. For major centres, the plan sets mode share targets for public transport. While no specific target is given for Green Square, a 2016 target is given to increase the proportion of total journeys to work by public transport in the Sydney Metropolitan Region to 28%. For work trips into Sydney CBD, public transport is given a target of 80% of journeys. The plan advocates increasing walking and cycling, with targets to more than double cycling's mode share and increase walking trips to 25% of all trips by 2016[18].

The *NSW Long Term Transport Master Plan* is a comprehensive and integrated strategy for all modes of transport across NSW over the next 20 years, focusing on key challenges around population growth, job creation and the need for a transport network that maximises the benefits to the economy and aligns with land use[19] . The plan identifies the Sydney Airport to CBD corridor as one of Sydney's most important corridors but also one experiencing high constraint. It recognises that managing the growing demand within and alongside this strategic corridor will be essential to securing Sydney's future economic growth and success. Green Square is recognised as Australia's largest urban renewal site and the plan identifies the future transport challenges in meeting the needs of the future residents and employees in the area[19] .

A Transport Management and Accessibility Plan (TMAP) for Green Square was completed in 2008 by Transport for NSW in conjunction with NSW agencies and the City of Sydney, with the aim of developing a common understanding of actions and responsibilities to manage transport infrastructure delivery and timeframes by key stakeholders. The 2008 Green Square TMAP identifies opportunities for establishing travel demand management strategies, encouraging active transport modes and developing effective policy to manage parking provision to reduce the growth

of car based trips over time in the area[20] . Aiming to achieve a 'no car growth' target, it identifies measures to improve accessibility, particularly by sustainable modes, and measures to limit the growth in private vehicle demand on the congested road network. The 2008 TMAP aims to achieve a public transport and active transport (walk/cycle) mode share of 70% for residents and 65% for workers in the Town Centre; and 60% for residents and 35% for workers in Green Square outside the Town Centre. Responsibility for programs and infrastructure delivery is assigned to relevant NSW agencies or the City of Sydney[20].

The 2008 TMAP was updated in 2012. The updated TMAP identifies significant transport implications of changed plans and policies, particularly large increases in residents and employees travelling to and within the Green Square area; proportionally higher potential growth in areas outside the Town Centre, such as in the City's southern employment lands and around Mascot railway station; growth in activities that generate higher rates of travel, both into and out of Green Square; a shift in the balance between inbound and outbound trips during the morning and afternoon peaks; and a strong patronage response to the removal of the station access fee at Green Square[20]. Despite the TMAP being updated in 2012 it has still not been publicly released. The City of Sydney notes that this is a critical issue for transport in Green Square (both public and private) as the TMAP 2012 details the transport measures that need to be implemented and the likely timeframe, but there is no clear commitment to implement the TMAP measures[20].

At local level, the City's *Sustainable Sydney 2030: The Vision* sees the southern part of the city including Green Square as an opportunity for considerable growth, infrastructure improvements, and redevelopment to contribute significantly to Sydney's sustainability[21]. The vision includes integrated transport and land use, and a focus on creating a city for walking and cycling, reflecting a trend in other global cities to encourage walking in view of its health, economic, and environmental benefits[21].

Consistent with this approach, the City of Sydney has also developed a draft *Walking Strategy and Action Plan* to outline benefits, set targets, actions, and implement improvements for walking. Green Square is included in this strategy [21]. In addition, the City's *Cycle Strategy and Action Plan* provides for a network of safe, connected, separated cycleways to accommodate future demand for cycling likely to be generated by development[22].

In March 2015 the City released the *Green Square Draft Infrastructure Strategy and Plan*, which sets out in detail the history of the site, the current status of development, and plans for the future.

This Plan includes a focus on streets and transport systems, and is discussed further in the final section of this report[20].

Potential health impacts of transport modes

The population of interest

The Green Square and City South Village estimated resident population in 2011 was 20,013 people, and this is projected to grow to at least 61,000 by 2030[23]. The 2011 Census showed that people living in the City of Sydney LGA were far more likely to use public transport or active transport (walking or cycling) to commute to work, rather than travel by private motor vehicle, compared with the population of Greater Sydney:

- 25% of City of Sydney LGA residents walk to work and 3% bicycle, while 4% of Greater Sydney residents walk, and 1% ride bikes.
- 29% of City of Sydney LGA residents take public transportation to work, compared to 20% Greater Sydney residents
- Residents of Greater Sydney are twice as likely to use private vehicles or taxis to get to work, at 60% compared to 28% of City of Sydney residents[24].

The main mode of travel to work for people living in the City of Sydney LGA varied significantly between the 2006 and 2011 Censuses, with more people reporting cycling (53% increase), using trains or buses (33% and 21% increases), or walking to work (22% increase). There was a smaller decrease of 11% in vehicle use[24].

The literature in relation to the health impacts of active transport, public transport, private vehicle transport, and transport connectivity is explored below, following which the implications of each of these issues for the Green Square development will be discussed.

Limitations of the literature review include:

- The literature reviewed included little information on rates of physical activity at a community-wide scale before and after a new development is built, and therefore does not support quantitative predictions for increases in physical activity.
- There is also a lack of longitudinal studies that examine the long-term impact of bicycle paths on physical activity.

- The 2011 Census data does not reflect population growth that has occurred since 2011, or the population mix that is projected to reside in the Green Square area as it continues to be constructed until 2031.

Health impacts of active transport

Active transport (primarily walking and cycling) is a key contributor to population health, as it builds physical activity into the day, and helps people meet physical activity targets that are key to good health[25].

Physical activity is a behaviour that is influenced by various factors, including social and economic contexts, individual preferences and the natural and built environments in which people live[26, 27]. In healthy communities, physical activity is a normal part of everyday life. Physical activity can be structured or unstructured, planned or incidental. Planned physical activity is a deliberate form of activity where the principal intention is to gain some form of exercise[28]. This may include going for a jog or lap swimming for exercise. Incidental physical activity is exercise gained through a person's normal daily activities such as walking to the bus stop, using the stairs at work or doing household tasks. Any movement that a person engages in (be it related to work, recreation, exercise, transport or otherwise) can be considered a form of physical activity[28].

There are few other lifestyle or health interventions that are as beneficial for individual and public health as regular physical activity. Health benefits associated with physical activity include the reduction of symptoms of stress and depression, and reduced risk for preventable injury, type II diabetes, certain cancers and the distribution of body fat[29, 30]. Studies suggest that active commuting has mental as well as physical health benefits[25, 31].

As noted earlier, the *2014 Australian Physical Activity and Sedentary Behaviour Guidelines* recommend healthy levels of physical activity for children and adults, and delineate the types of physical activity necessary to ensure good health; as well as covering the need to reduce sedentary behaviour[13]. NSW guidelines also recommend that physical activity should continue throughout the life-cycle[32]. Studies have shown that only one-third of children, and one in ten young people undertook the recommended 60 minutes of physical activity every day; and that 60% of Australian adults did less than the recommended 30 minutes of moderate intensity physical activity per day[33].

Sedentary behaviour is known to have a highly negative impact on health[34] . Although the underlying determinants of sedentary behaviour are not yet fully known, interventions to reduce

sitting time, 'screen' time, and sedentary transport are recommended[34]. Fewer than one in three children and young people (5-17 year olds) meet recommendations for "no more than 2 hours of screen-based entertainment" every day; and nearly 70% of Australian adults (almost 12 million adults) are either sedentary or have low levels of physical activity[33].

Physical inactivity is the fourth most significant modifiable risk factor for non-communicable diseases (after tobacco use, high body mass and high alcohol use) [35]. In 2003, physical inactivity accounted for approximately 6.6% of the disease burden in the Australian population[13, 36]. Physical inactivity is the second greatest contributor, behind tobacco smoking, to the cancer burden in Australia[37]. It is estimated to be the main cause for approximately 21–25% of breast and colon cancers, 27% of diabetes and approximately 30% of ischaemic heart disease burden globally.

Low levels of physical activity are also a key factor in rising levels of overweight and obesity. In 2013 29% of Australians ranked as obese, compared to 16% in 1980[33]. The Australian National Children's Nutrition and Physical Activity Survey has shown that, nationally, approximately 72% of 2-16 year old children are of a healthy weight, but 17% are overweight, 6% obese and 5% are underweight[38].

Physical inactivity is correlated with socio-economic disadvantage. In NSW approximately half (52%) of all adults are overweight or obese, and only approximately half of the adult population participate in an adequate level of physical activity[39]. Across NSW rates of physical inactivity are approximately 14% higher in the most disadvantaged locations compared to the most advantaged, and overweight and obesity rates are approximately 8% higher[35, 40]. Australian research indicates that women, middle- aged and older adults, non-English speaking groups, parents of young children and those with lower educational attainment are less likely to achieve physical activity recommendations[41].

Overweight and obesity within the Sydney Local Health District population is lower than the NSW average, with 27% of people aged over 16 years overweight and 13% obese[42]. Approximately half (52%) of City of Sydney residents undertake inadequate physical activity, 30% are overweight (steady since 2006) and 14% are obese (trending slightly upwards). An estimated 7.5% of adults in the City of Sydney are living with diabetes. This is higher than desirable and also trending upwards[43].

The total financial costs of obesity have been estimated for 2005 at approximately $3.8 billion across Australia. NSW has the highest cost burden, estimated as $2.7 billion in direct financial costs and $16.3 billion in net costs of 'lost wellbeing'[44].

Designing built environments to encourage walking and cycling is key in maintaining and improving the health of urban populations[45, 46].

Walkability and cyclability refer to the extent to which the built environment supports or hinders walking and cycling in terms of safety, connectivity and convenience. Living in a neighbourhood that is walkable and cyclable – for example, where housing is close to shops and services, streets and pathways are highly connected, public transport is available, and walking and cycling is safe – is associated with higher levels of physical activity[47]. Density, land use mix, street layout, access to public transport and micro-design factors including streetscape and pathway design are important factors impacting on levels of walking and cycling [48]. The Heart Foundation has summarized the key factors that encourage walking under seven key criteria: density, design quality, diversity of land uses, destination accessibility, distance to public transport, demand management of parking provision, and overall place-making[26].

The following examples illustrate how some of these factors can affect people's propensity to walk or cycle:

- Destination proximity and accessibility: Walkable neighbourhoods can provide ease of access to key destinations such as employment, education and services. A distance of 400 – 500 metres (or approximately 5 minutes of walking) between destinations is a generally accepted measure for a comfortable walking distance for most people[49]. However, various studies have shown that the more desirable the destination, the further people are willing to walk or cycle to access it; for example, people will walk further to access public transport or other important services (Besser and Dannenberg 2005). Quality and pedestrian-orientated, human-scaled urban design can also influence and extend the distances that people are willing to walk between destinations[50]. In Victoria a study of 2,349 participants supports the idea that a mix of destinations supporting daily living accessible in a single trip can provide an incentive to walk[51]. A review of 46 studies exploring the attributes that would encourage walking indicates that utilitarian walking is associated with the presence and proximity of destinations (shops, transport, school, work) in 80% of studies[52]. Other studies indicate that trips by walking and cycling grow with increased housing density and mix of land uses, and that mixed uses within buildings can help increase the diversity of land uses in higher density areas[53].

- The design of pathways and other public spaces: Positive design aspects such as providing awnings along pathways and designing pathways to avoid steep slopes can encourage walking[54]. A Western Australian study has found that paved footpath length was a positive impetus to walking for transport (although not necessarily for recreation walking)[55]. On the other hand, poor design can present a real or perceived threat to people walking or cycling. Layout, landscaping and inadequate lighting can create areas of concealment and/or make casual surveillance or emergency response difficult. Similarly, poor maintenance and management of public spaces can negatively impact on perceptions of neighbourhood safety, which can challenge physical activity [56]. In Western Australia, localities with higher overall levels of 'greenness', were associated with higher levels of physical activity and a lower proportion of overweight or obese residents[55].

- Traffic safety: Traffic danger (both real and perceived) can discourage people from walking and cycling[3], and from allowing their children to do so. Fear of falling and inadequate time to cross intersections is also a key concern for children and the elderly[57]. Parents' and children's concerns about risk of traffic injury are well founded. Younger children appear to be more at risk of traffic injury than older children[58]. Children aged ten and under often lack the cognitive abilities including attention focus and interpreting traffic signs, and perceptual abilities such as locating sounds, judging speed, and peripheral vision, to negotiate complex traffic situations[59]. Traffic speed and volume, the availability and design of controlled crossings, the extent of illegal or dangerous parking, visibility levels, and levels of supervision at pedestrian crossings are safety factors consistently associated with the extent to which children are allowed to play and interact with their neighbourhood[60]. Low traffic exposure has been shown to be a key contributor to neighbourhood safety[61]. Studies have shown that increasing the number of people walking and cycling in an area improves road safety, as motorists take more care when driving in these areas[62]. Street crossings (including side streets and driveways) can be a major challenge to walking and cycling, and intersections with wide streets often have high pedestrian crash rates[49]. A study in Melbourne indicates that parental views on perceived road safety are a major factor in encouraging girls aged between 15-17 to engage in physical activity[63]. Safe conditions for children and youth to walk and cycle to school are associated with higher levels of active transportation to school, higher levels of physical activity, and lower rates of injury[63]. The time spent by pedestrians and cyclists waiting to cross streets affects the comfort and desirability of walking and cycling as a transportation mode. Pedestrians and cyclists are more likely to ignore the signal (and risk injury) if wait times are perceived as too long[64, 65]. Improvements can be

made through the implementation of 'complete streets', 'better block' programs, and reduction of carriageway widths available for vehicles[49].

- Street layout: Grid street patterns are considered to help create greater connectivity, slow traffic speeds and decrease distances between destinations – factors that can encourage more walking and cycling. However, a range of design features must be considered in creating built environments that are conducive to walking and cycling [53]. These include (but are not limited to) street surfaces, street widths, the existence of separate pedestrian and bicycle paths, and the quality of streetscapes. Street blocks generally in the range of 70m wide by 120-240m long, with shorter blocks at town and neighbourhood centres, are considered more walkable [66].

- Proximity of walking and cycling paths: Multiple studies have shown that people living near trails or multiuse pathways get more exercise than people who do not [49, 50, 65, 67] and that people who use pedestrian or multiuse trails are more likely to meet physical activity requirements [67]. Studies of multiuse paths and walking trails consistently show that people are more likely to use facilities if they live close by[13, 42, 44, 49, 50, 66]. While there is no definitive "cut-off" distance, proximity to users' homes has been found to be one of the most important predictors for trail use in diverse locations in the USA[42, 51, 52, 66]. Proximity and convenience may be especially important for new exercisers [55]. However, even for nearby trails, busy streets between peoples' homes and trail facilities can be a barrier to use [15]. While pathway proximity is important for users on foot and bicycle, research has also shown that cyclists are willing to add distance to their trips to use safe and attractive facilities. Studies of how far cyclists will travel to use off-road trails have found varying results, ranging from adding 10% of the trip's distance, to between 0.5 and 1.5 miles [49]. While most research has been done with adult populations, at least one study has found that availability of non-motorized trails was associated with greater likelihood of physical activity and lower obesity rates among some adolescent age groups [68]. New facilities have been shown to increase pedestrian and cyclist activity in the areas they are constructed, with increases in use each year for the first several years after they are conducted [56, 69, 70]. There have been mixed results as to whether they increase overall levels of walking and biking, or whether users shift their activity to new facilities [56, 70].

The literature also explores the relative importance of each of these built environment factors which impact on walking and cycling, and the interactions between them. An international review indicates that overall density of potential activities and a walkable environment may be a higher determinant of walking levels than issues of overall safety and actual recreational facilities [67]. A Melbourne study

found that there was no significant association between walking and park areas within 400 metres of homes, and that street connectivity, and density of population and land use may be more important factors [68].

Obese or overweight adults in the United States have indicated that a range of factors including weather, lighting, inadequate shade and seating, unattended dogs, disconnected footpaths, the quality of walking surfaces and a lack of interesting places are all barriers to walking or to walking more[69].

A study of factors affecting the propensity for older adults to walk for transport found a combination of eight elements: access to facilities, walking facilities, traffic safety, familiarity, safety from crime, social contacts, aesthetics and weather [70]. A study in Victoria identified uncontrolled dogs, poorly maintained or lit footpaths, and drivers and cyclists failing to give way as the main inhibitors [56]. Similarly it has been found that a close density of accessible neighbourhood facilities near to retirement villages is more likely to promote overall levels of physical activity by residents than if those facilities are provided within the residential village itself[70].

There is good evidence that positive urban design can increase levels of walking. A study of a new neighbourhood in Texas designed on 'New Urbanist' principles showed significant increases in physical activity amongst residents who were previously not as physically active [71]. Similarly, a study of an immigrant population living in different localities in the United States shows that for each 10-point increase in the Walkscore rating of the neighbourhood there was a 19% increase in the likelihood of walking, a 26% increase in meeting recommended physical activity levels, and a 27% increase in time spent walking [72]. A longitudinal analysis in England showed that walking amongst older adults increased following design improvements in the locality[73].

Against a backdrop of increased urban density and traffic congestion, cycling offers a healthy viable transport mode. Research suggests that countries with more separated and off-road cycling facilities have a higher share of cycling and greater levels of bicycle safety. Living closer to work, the speed of vehicle traffic, and distance to destination are key factors influencing cycling behaviour[74, 75]. A recent University of Sydney study found cycling to be the most enjoyable form of transport, followed by walking[76].

Cycling is generally a higher-intensity activity than walking and can be particularly valuable in promoting physical fitness. In Sweden it has been found that children who cycle to school have higher levels of fitness than those who walk or use 'passive' modes of transport[77].

However, there are many constraints to cycling, particularly safety concerns with regard to cyclists sharing roads with motor vehicle traffic. In Queensland constraints to cycling have been identified as traffic conditions, motorist aggression and safety, leading to a preference for off-road cycle paths[78].

While perceived safety influences all cyclist groups, inexperienced cyclists, women and younger cyclists tend to consider off road bicycle infrastructure to be more important[75, 79]. Experienced cyclists have different preferences, often finding wide curb lanes such as bus lanes more desirable than bicycle lanes[80]. Inexperienced cyclists and time poor commuters often prefer continuous networks, that is direct routes which do not require the rider to get off the bike to walk or change mode. End of trip facilities such as safe bike parking and showers also influence many riders[75, 81].

Local governments are largely responsible for building and maintaining local cycling infrastructure. Cycling for recreation and for commuting to work has increased significantly in the City of Sydney Council area in recent years, correlating with increasing provision of cycling infrastructure and community education by the Council. As noted earlier, there was a 53% increase in commuting to work by bike between 2006 and 2011 for City of Sydney residents.

Health impacts of public transport

As cities grow and urbanise they need to become less car dependant to transport larger numbers of people. Data suggest that the more a city has committed itself to public transport infrastructure, the less the city spends overall on transport; and the more a city has built itself around car dependence, the more of the city's wealth is required to be committed to just getting around[82]. Car dependence is expensive in time and operating costs. At 2005 prices car travel was estimated to cost around 85c per passenger kilometre compared to 50–60c per passenger kilometre for public transport[83].

The provision of public transport offers both efficiency and equity, providing an opportunity for all people to travel, and providing access to services including markets, employment, health services, and education Krygsman et al. cited in[84].

A public transport journey (by bus, train, ferry, or tram) is usually accompanied by a walk or bike ride to the transport stop or station. More than four out of 10 (44 per cent) Australian adults who live in a capital city walk for day-to-day trips other than to work or study, but this varies considerably by location. In 2011, 29% of residents living in the City of Sydney reported catching public transport and a further 25% walked to work[24].

More than a quarter of education and childcare trips (26 per cent) were made using public transport, while walking accounted between one-fifth and one-third of all trips in Sydney in 2010–11 for personal business (21 per cent), shopping (28 per cent) and social or recreational travel (29 per cent)[85].

Transport modes vary across age groups. People aged 70 and over have the highest proportion of walking-only trips (26 per cent) followed by 21–30 and 61–70 year olds (20 per cent for each). The 11–20 year old age group has the highest overall proportion of public transport trips (24 per cent), while the youngest age group (0–10) has the lowest (five per cent)[85]. Combining walking and public transport the 11–20 year old age group are the most active travellers, with 45 per cent of their trips made using active transport modes[85].

People who use public transport are more likely to be physically active than people who drive, as they often walk to and from transit stops. Public transport extends the distances that people travel by foot and bicycle because it is associated with higher levels of incidental physical activity than private vehicle use[57]. In addition, lack of public transport can contribute to inadequate access to vital goods and services, including jobs, healthcare, and healthy food[86, 87].

In some localities, private car use is being dissuaded by greatly increasing the efficiency, convenience and comfort of public transport use. Improvements to public transport include more express routes, greater security, improved frequency of service, internet access for passengers, more comfortable seating and smoother, quieter rides[88]. For example, reduced private car use has been effective in the Central Park development at Broadway which is located near accessible public transport, is intersected by dedicated walking and cycling paths to desirable locations and has shared vehicles in an on-site, secure carpark[89].

Increased use of public transport could result in more people reaching healthy physical activity levels. Applying research literature findings to a sample study of NSW adults found that if 20% of all inactive adults increased their walking by 16 minutes per day for five days per week there would be

a 7% increase in the proportion of the adult population considered to be 'sufficiently active'; and that public transport use could yield between 8 to 33 minutes of physical activity per day[90].

Health impacts of private vehicle transport

High density environments are often characterized by high traffic exposure, and this can have direct negative health impacts on health due to air pollution and motor vehicle accidents; as well as indirect negative health impacts, as high traffic levels can lead to reduced physical activity due to walking and cycling being perceived as less safe, particularly for children and for elderly and less mobile people.

In addition, beyond challenging our ability to achieve minimum physical activity guidelines and posing other personal health challenges, reliance on private vehicles for transport can have negative effects on our mental health and sense of community as well as being a major contributor to air pollution and greenhouse gas emissions[2, 3]. Reducing the kilometres travelled by private vehicle and encouraging more active forms of transport (including public transport use) is an important objective for healthy urban development and environmental sustainability.

Moderate to highly motorised cities such as Sydney with limited public transport outside major hubs are highly reliant on private motorised transport, resulting in increased exposure to the health risks associated with traffic speed, traffic volume, vehicle emissions, and physical inactivity[1].

Residents of higher density areas with accessible public transport and walkability have tended to have lower levels of car ownership and walk or cycling more often than residents in the suburbs[3]. However, the research suggests increasing residential density alone does not necessarily encourage increased physical activity. Other factors such as good built design (adequate paths, amenity, open space), safety and personal mobility influence levels of active transport. The intuitive notion that higher density may encourage physical activity is now being substituted in the research by the concept that socio-economic status, density, mixed use and micro-design elements in some combination are most likely to influence levels of physical activity[91].

As might be expected, car ownership in the City of Sydney is lower than for Greater Sydney. In 2011 34.7% of households in the City of Sydney stated that they did not own a car, compared with 11.8% in Greater Sydney. While the proportion of City of Sydney households not owning a car increased from 29.4% in 2006 to 34.7% in 2011, the absolute number of cars increased from

41,461 in 2006 to 55,283 in 2011, an increase of 13,819 cars in a 5-year period, due to the increasing number of households in the City[92].

Urban and suburban sprawl, poor public transport infrastructure and separation of jobs, schools and other services from housing have been shown in the past to be some of the factors encouraging high levels of private car use for travel (approximately 80% of all trips) in Sydney [93]. These factors, along with lack of access to quality open space and recreational facilities, can negatively impact on individuals' physical activity choices.

In 2011-12 26% of trips under 1 km (that is, within 15 minutes walking time) in Sydney were made by car[94]. Nearly 70 per cent of commuters travelling less than five kilometres to work or study travel by car. This represents nearly 14 per cent of all trips to work[94].

Air pollution is a major but poorly recognised cause of ill health and mortality, particularly among children. Motor vehicle emissions including diesel vehicle emissions are major sources of air pollution in urban environments [95].The known health impacts of air pollution are serious, particularly for people more susceptible to short-term exposure to even low levels of pollutants. Very small particles penetrate further into the lungs than larger particles, and are more strongly associated with adverse health effects. Diesel engine emissions are a significant risk as they are high in ultrafine particles and contribute disproportionately to the very-small-particle fraction of urban air pollution. Because of their small size, these particles can be inhaled deeply into the lungs and deposited in the alveoli. Diesel particulate has been classified as a carcinogenic (cancer causing, particularly lung cancer) by the World Health Organisation[96].

Children's exposure to air pollution is a special concern because their immune system and lungs are not fully developed. Their substantive risk for respiratory problems is greater, especially in impacting on lung growth, and exacerbating diseases for those with underlying chronic respiratory conditions such as asthma, ranging from minor respiratory symptoms to increased hospital admissions and mortality[97]. Pollution also stimulates atopy, which is a tendency to develop allergic diseases such as allergic rhinitis, asthma and atopic dermatitis (eczema), typically associated with heightened immune responses to common allergens, especially inhaled allergens and food allergens (Schwartz 2004). Prenatal exposure to air pollution is associated with early foetal loss, preterm delivery, and lower birth weight [97].

Note that an estimated 7.2% of adults in the City of Sydney are living with asthma (the asthma rate for children in the City is unavailable)[43].

A large amount of illness and mortality could be avoided through emission-control strategies, which have improved in recent years, for example through improved fuels and pollution-control technology for cars; and through increased public transport use and thus reduced car use[95].

Studies suggest that car-sharing programs have potential health benefits by helping to reduce private car ownership and/or change travel behaviour[98]. The City of Sydney car share policy aims to increase the uptake of car sharing to 10% of all households by 2016. This will be achieved by continued support for on-street car sharing and the placement of shared cars in city car parks; new planning controls to integrate car sharing into urban renewal areas; greater marketing and education, and continued enforcement of dedicated car share spaces[89].

An example of good implementation of car share in an area of high density living is the high end Central Park development at Broadway. A fleet of 44 car-sharing vehicles across the high-rise's underground and above-ground parking lots is available to the tens of thousands of residents and renters in the surrounding areas. The development has limited car parking, with 736 car spaces for 1428 apartments and low need for regular car use because of good public transport connectivity and close access to the city and mixed use facilities[99].

Health impacts of transport connectivity

Large parts of Greater Sydney have public transport that is poorly integrated with existing development and not conducive to more active forms of transport [40]. In areas of poor transport connectivity, on average, residents own more cars and drive more kilometres than residents in sections of Sydney where densities are greater. There is also a significant socioeconomic gradient with better paid jobs closer to the CBD, and people with higher education and income levels generally living closer to the CBD and other desirable locations.

Pedestrian and bicycle infrastructure that connects to transit stops makes it easier for users to make multimodal trips, reducing the need for cars and also encouraging physical activity.

Public transport connectivity involves locations being fully connected by public transport, but the important link is accessibility. In urban areas transport connectivity is often associated with the density of connections, the directness of links in local public transport, and walkable access. Ease

of access to relates to reliability and frequency of service, more express routes, greater security, and passenger comfort, including elderly and disabled passengers[88].

Transport connectivity is a particular issue for people with a disability. Better access to transport is vital in enabling people with disability, their families and their carers to overcome social exclusion and participate wholly in community life[100]. People with restrictions in core activities have less access to available transport options and experience more difficulty getting or are unable to travel compared to people without disability.

Recognising that people with disability are more likely to experience poor health, lower levels of participation in education, social exclusion, lack of access to goods, services and facilities and ongoing discrimination, the Australian Government[101] identifies 'inclusive and accessible communities' that include a 'public, private and community transport system that is accessible for the whole community' and the implementation of a 'continuous accessible path of travel for people with disability' as areas for future action. Measures have been taken to reduce barriers for people with disability, such as the adoption of the Disability Standards for Accessible Public Transport[102]. The Transport Standards specify minimum public transport accessibility levels under the Disability Discrimination Act 1992, and set a timetable for compliance.

Reflecting these needs, in the City of Sydney, people holding a mobility parking permit can enjoy free parking in parking zones with meters or ticket machines for a certain period of time.

Summary of potential key health impacts of transport modes and connectivity

Potential health impact	Likelihood	Severity	Populations impacted
Health impacts of active transport	Built environments that promote walking and cycling have been shown to make a major contribution to physical activity levels across the life span and reduce sedentary behaviour.	Failure to meet minimum physical activity requirements substantially increases risk for overweight and obesity and for chronic disease including diabetes, heart disease, and several cancers; as well as impacting on rates of	Households and individuals with inadequate access to active transport infrastructure and whose key destinations are not within ready walking/cycling distance. The majority of Australian adults and children fail to meet physical activity recommendations and rates of overweight and obesity are growing and are inversely linked with

		preventable injury and mental health problems including the symptoms of stress and depression.	socio-economic status. Women, middle-aged and older adults, non-English speaking groups, parents of young children and those with lower educational attainment are less likely than other Australians to achieve physical activity recommendations.
Health impacts of public transport	People who use public transport are more likely to be physically active than people who drive, as they often walk to and from transit stops. Public transport extends the distances that people travel by foot and bicycle because it is associated with higher levels of incidental physical activity than private vehicle use.	Lack of access to public transport impacts on physical activity levels, with consequences outlined above; impacts on disadvantaged groups' access to jobs and services, with wide-ranging health implications; and promotes dependency on private motor vehicles, with health impacts as outlined below.	Households and individuals with insufficient access to public transport, including those living relatively far from public transport stops.
Health impacts of private vehicle transport	Highly likely that private vehicle transport will have widespread health impacts. In 2011-12 26% of trips under 1 km in Sydney were made by car, and nearly 70 per cent of commuters travelling less than five kilometres to work or study travel by car. While the proportion of City of Sydney households not owning a car increased from 29.4% in 2006 to 34.7% in 2011, the absolute number of cars increased from 41,461 in 2006 to 55,283 in 2011, an increase of 13,819 cars in a 5-year period, due to the	The adverse health effects of motorised travel include road-traffic injuries; increased risk of non-communicable diseases arising from physical inactivity as outlined above; diseases arising from air pollution including respiratory disease and cancers; and negative impacts on mental health.	People commuting by car are at increased risk for road traffic injuries and inadequate levels of physical activity. People living on busy road transport routes are at increased risk of illness arising from air pollution; and children are particularly at risk.

	increasing number of households in the City.		
Health impacts of transport connectivity	Full transport connectivity can increase active and public transport and reduce private vehicle transport, maximising the health gains outlined above. Pedestrian and bicycle infrastructure that connects to transit stops makes it easier for users to make multimodal trips, reducing the need for cars and also encouraging physical activity. Public transport connectivity requires fully connected locations with dense connections, direct links, and walkable access to transit stops.	Fully connected active and public transport systems minimise the health risks and maximise the health gains outlined above in relation to active, public, and private vehicle transport.	Households and individuals with inadequate access to fully connected active and public transport, particularly elderly people and people with disabilities and mobility issues.

Implications for Green Square development

Transport systems for Green Square are covered in some depth in the *Green Square Draft Infrastructure Strategy and Plan*[20].

The Plan acknowledges the need for a co-ordinated approach to the management of traffic and public transport, and the integration of land uses and transport. The Plan recognises the need to increase the use of active transport for local trips and public transport for further destinations, to minimise car trip generation from current and new residents and businesses. It is noted that continued increases in traffic growth through the Green Square area would result in severe congestion.

Integrated transport planning in a development such as Green Square requires co-ordinated planning between State Government departments and agencies, the City of Sydney, and developers. This has been occurring over an extended period, most recently through the establishment of a Green Square Transport Steering Committee and Working Group in 2013, which involve State and City representatives.

As noted earlier in this report, the 2008 Transport Management and Accessibility Plan (TMAP) for Green Square aims to achieve a 'no car growth' target, and identifies measures to improve accessibility, particularly by sustainable modes, and to limit the growth in private vehicle demand on the congested road network. The 2008 TMAP aims to achieve a public transport and active transport (walk/cycle) mode share of 70% for residents and 65% for workers in the Town Centre; and 60% for residents and 35% for workers in Green Square outside the Town Centre[20].

Also as noted earlier in this report, the TMAP 2008 was updated in 2012; however, the updated TMAP has not been released, and commitment to implementation of the TMAP recommendations is unclear[20].

The City of Sydney notes that based on changing planning controls for Green Square including an increase in residential development potential in the Town Centre, and changes to NSW Government's planning strategies and infrastructure priorities, the TMAP 2008 target of 'no car growth' is considered a significant challenge and there is a high risk of it not being achieved[20].

Against this background, in relation to the key health impacts covered in this report, the implications for the Green Square development are as follows.

Health impacts of active transport

The literature review undertaken for this report has confirmed that active transport (primarily walking and cycling) is a key contributor to population health, as it builds physical activity into the day, and helps people meet physical activity targets that are key to good health.

Health benefits associated with physical activity include reduced risk for overweight and obesity, for preventable injury, and for a range of non-communicable diseases including type II diabetes, and certain cancers. Physical activity has mental as well as physical health benefits, including the reduction of symptoms of stress and depression. Yet the majority of adults, young people and children in Australia fail to meet minimum physical activity requirements for good health, which is a major concern in the context of rising rates of overweight and obesity, and chronic disease.

Designing built environments and connected transport systems that encourage walking and cycling is key in maintaining and improving the health of urban populations. There is good evidence that positive urban design can increase levels of active transport. Some aspects of the built environment which are important in promoting active transport include:

- Proximity of key destinations such as schools, shops, workplaces, and services to housing.
- Proximity of walking and cycling paths to housing, and street layout that encourages trips by foot or by bike (for example, small block sizes and allowance for through movements).
- Inter-connected walking pathways and cycleways, including connectivity to public transport stops and stations.
- Safety of walking paths and cycleways, including separation from road traffic and parked vehicles, traffic calming and speed reduction measures, safe/controlled road crossing points with frequent and adequate crossing times (including for children and the elderly), layout and landscaping that increases visibility and emergency access, and adequate lighting.
- Navigability and comfort of walking paths and cycleways, including appropriate surfaces, shelter from sun, wind, and rain, gentle gradients, and good repair and maintenance.
- Increased housing density and appropriate mix of land uses.
- Measures to discourage ownership and use of private cars.

The City of Sydney recognises the importance of planning and delivering walking and cycling related infrastructure for Green Square, and notes that redevelopment provides opportunities to open up areas of land through the construction of new roads, separated cycleways, footpaths, and plazas, and to increase pedestrian and bike connections [20].

As noted earlier, other City of Sydney strategies and plans include a focus on promoting and enabling walking and cycling. These include the City's *Sustainable Sydney 2030: The Vision;* the draft *Walking Strategy and Action Plan* to outline benefits, set targets, actions, and implement improvements for walking, including in the Green Square development; and the City's *Cycle Strategy and Action Plan* provides for a network of safe, connected, separated cycleways to accommodate future demand for cycling likely to be generated by development. Note that the City's broader cycle network connects with Green Square and is linked to regional routes that will connect cyclists to major destinations including the CBD, the airport, and universities. It is unclear, however, whether the aim of the cycle strategy to "allow people of all bike-riding ability to choose to use a bicycle to safely travel through Green Square and the adjacent neighbourhoods" will be achievable for less experienced cyclists and children, given that the cycleways will be a mix of dedicated lanes, shared paths with pedestrians, shared zones and contraflows [20] .

The decision of some residents to use paths may be impacted by their perception of safety. For example, the need to walk or ride with traffic or even just to cross roads in high traffic areas may reduce the ease and appeal of walking or cycling. For others, a primary concern may be safety from experienced or fast-moving bicycles. Heat is also a concern, and with the number of days annually

with temperatures above 40 degrees Celsius predicted to increase, the comfort and health of active transport decreases.

The focus on creating a connected infrastructure of safe and user-friendly walking paths and cycleways is, overall, commendable. Additional measures are suggested to ensure these facilities are truly useable by people of all ages and abilities. Measures must be in place to ensure the safety of users of footpaths and cycleways, and the provision of facilities such as shade, rest points, and water may also assist in greater uptake by a broader range of users. The City has included reference to such needs in various documents and it will be important they are fully addressed in the Green Square walking and cycling infrastructure.

In addition to dedicated walking and cycling infrastructure, as noted above there are many other elements that also influence levels of walking and cycling and these elements also warrant consideration. For example, proximity of housing to key destinations is an issue that may require further consideration by the City.

Local destinations, infrastructure and services become increasingly important as urban density increases[103, 104]. It has been shown that families are more likely to use destinations and services located within walking distance of their home[105, 106]. The *Green Square Draft Infrastructure Strategy and Plan* promotes access to usable and quality public open spaces and recreational facilities such as the district aquatic centre, library and community spaces [20]. In the town centre and in some other locations, there will be destinations such as shops and cafes that people living close by can easily walk to.

However, proximity of other destinations, including primary schools, is a potential concern. Active transport to and from school is highly desirable in ensuring more children meet physical activity recommendations. Time and distance, along with safety, are key factors that influence whether children or adolescents walk or cycle for transport to school and other destinations [107, 108].

An *Essential and Social Infrastructure Plan* commissioned by the City has assessed school requirements for Green Square [109]. The report notes that there is one primary school located within the Green Square and City South Village boundary (Gardeners Road Public School). There are also two other schools in the Green Square catchment area: Alexandria Park Community School, and Bourke Street Public School. The NSW Department of Education and Communities has advised the City that it has capacity in existing buildings to accommodate projected increases in

primary school student enrolments for at least the next 10 to 12 years, including through expansion of these premises. Notably, the Department is redeveloping Alexandria Park Community School to cater for up to approximately 1,000 primary school students and up to approximately 1,200 secondary school students[110].

The expansion of capacity in the three existing schools in the Green Square enrolment catchment area, two of which are outside the precinct, clearly will not ensure that all primary school aged children in Green Square will have access to a local school within walking/cycling distance of their homes. This will present major barriers to active transport to and from school, and will increase traffic problems around existing schools, all impacting on healthy child development. It appears from these findings that it will be a priority for the City to work with the NSW State Government to ensure the provision of sufficient high quality local primary schools, within easy walking/cycling distance of people's homes, throughout Green Square.

A thorough examination of the proximity of other key destinations to residential homes in Green Square is suggested, to ensure it is possible to meet the objective of local trips being made as far as possible by active transport.

Health impacts of public transport

This report has noted that investment in public transport infrastructure has significant health and economic benefits, while car dependency has negative health and economic impacts.

The positive health impacts for users of public transport largely accrue from the fact that public transport journeys are usually accompanied by a walk or ride to the transport stop or station, increasing incidental physical activity and achieving the benefits outlined above in relation to active transport. In fact research indicates that the incidental physical activity associated with public transport use often represents a "tipping point" which takes a significant number of users from inadequate to adequate levels of physical activity on a regular basis.

A secondary health benefit derives from the fact that provision of effective public transport increases equity, providing an opportunity for all people to travel, and providing access to services and goods including employment, health services, education, and healthy food. Opportunities for social interaction are also increased.

The public transport infrastructure situation in Green Square is as follows[20]:

- Rail services: Green Square rail station is served by Sydney Trains' Airport and East Hills Line, carrying ten trains per hour in the morning peak, with four to eight in the off-peak. Patronage on this line is growing rapidly, influenced by the abolition of the station access fee at non-airport stations including Green Square, the delivery of thousands of new dwellings and jobs along the line, and growing airport use. However, until a second harbour rail crossing (Sydney Rapid Transit) is completed, capacity constraints on the City Circle will severely limit a growth in frequency on the Airport Line. The City predicts that Green Square is likely to be substantially complete before the new rail infrastructure is available, meaning passenger demand equivalent to at least 20 trains per hour will have to contend with a maximum volume of 12 to 14 trains per hour. This will impact on travel by bus and private car, adding to road congestion.
- Bus services: Green Square is currently served by several bus routes operated by the State Transit Authority, and planning for new routes and additional services is being undertaken by Transport for NSW and the City of Sydney. Growth in bus patronage has been moderated by a preference for rail services from Green Square station, but as more development is completed further from the station, bus patronage is likely to increase significantly and an increase in services will be required to prevent crowding on buses.
- Light rail: The need for high capacity surface transport in Green Square has been recognised in the safeguarding of a 5 kilometre Eastern Transit Corridor (ETC) providing a north-south public transport route linking Central Station to areas of very high residential density that are predominantly outside the 800 metres walking catchment of Green Square rail station. The corridor is suited for buses and exceptionally suited to light rail, and would allow interchange with a number of east-west bus routes and with the Airport Line. Delivery is contingent on securing the full connected corridor, and the City is seeking assistance from the NSW Government in achieving this.

It is clear that there is significant uncertainty around the provision of adequate public transport services for Green Square. Sufficient rail services are contingent on the completion of the Sydney Rapid Transit project, and light rail is contingent on securing the full connected Eastern Transit Corridor. In the absence of adequate rail services and a light rail system, there will be increased pressure on the bus system and increased used of cars. This will clearly lead to further road congestion and will have undesirable health impacts in addition to the obvious economic impacts.

To achieve the TMAP targets of no car growth and increased public transport utilisation, it is urgent and critical for the City of Sydney to achieve commitment from the NSW State Government for timely completion of the Sydney Rapid Transit project and delivery of adequate rail services for

Green Square; and assistance to secure the Eastern Transport Corridor and commitment to deliver a new light rail service through that corridor. The delivery of increased bus services will be an important and necessary measure but will not deliver the level of benefits that will accrue from rail and light rail.

Health impacts of private vehicle transport

This report has demonstrated that reliance on private motorised transport results in increased exposure to the health risks associated with traffic speed, traffic volume, vehicle emissions, and physical inactivity. The adverse health effects of motorised travel include road-traffic injuries; increases in non-communicable diseases including type II diabetes, heart disease, and several cancers due to physical inactivity; serious respiratory illnesses and cancers arising from air pollution; and negative impacts on mental health. Traffic congestion also takes up people's time, impacting on wellbeing as people who spend more time in cars have less time to exercise, socialise and spend time with family. While the 2008 TMAP aimed to achieve no car growth in Green Square, as noted earlier it is acknowledged by the City of Sydney that there is a high risk of this not being achieved.

It appears that increased road traffic and congestion is likely in Green Square, due to a rapidly increasing population living and working in the area, lack of capacity in the public transport system, inadequate infrastructure support for active transport, and the impact of WestConnex. WestConnex is a NSW Government project that seeks to integrate the M4 extension, M5 East expansion, and inner west bypass. Financing is based on private tolls and the roads are expected to carry more than 90% private traffic. The City has commissioned a review of the potential impact of WestConnex on the City's southern suburbs. The findings indicate, among other things, that WestConnex will impact on traffic in Green Square, which is already seriously congested[20].

As noted above, the City of Sydney has undertaken a number of studies to understand the likely impacts of additional traffic in Green Square and how best to manage this traffic. Strategies being considered include low speed zones and traffic calming measures; optimal alignment and configuration of new roads and intersections; optimal management of traffic at intersections; appropriate parking policies; and measures to limit traffic volumes in local residential streets, for example through one-way streets and turn movement bans[20]. While these measures may mitigate some of the impact of increased traffic volumes, they do not address the volumes themselves. It has been noted that infrastructure that encourages active and public transport use and discourages

private motor vehicle use is a key strategy in managing traffic volumes, and strategies have been outlined to achieve this.

To discourage private car ownership in the City of Sydney, the City has regulated to limit the number of car parking spaces within developments, to manage car dependency among new residents, workers, and visitors in an area. A restrictive car parking policy is seen as fundamental to achieving core transport goals. The City is reviewing car parking controls that apply to the Green Square development with the goal of discouraging private car use and reducing trip generation; one factor that the City is examining is the major growth in car share schemes[20]. Research suggests car-sharing programs have potential health benefits by helping to reduce private car ownership and/or change travel behaviour, so measures that promote car sharing should be encouraged.

The City could also consider other innovative economic incentives to encourage uptake of active and public transport, and to disincentivise private car ownership and use, based on global best practice. For example, strategies including car-free areas, employer incentives for active transport, road tolls and other road pricing strategies could be considered.

Health impacts of transport connectivity

This report has noted that a fully integrated and connected active and public transport system is essential to maximise uptake of and health benefits from walking, cycling, and use of public transport, and to minimise reliance on cars and the negative health impacts that accrue from motor vehicle use.

Transport connectivity requires pedestrian and bicycle infrastructure that is close to housing, that is inter-connected, and that connects users to key destinations and to public transport stops. Within the public transport system, connectivity requires accessibility by walking, density of connections, directness of links, reliability and frequency of service, more express routes, greater security, and passenger comfort, including for elderly and disabled passengers.

The City of Sydney is aware of the importance of transport connectivity. One reflection of this is the Liveable Green Network, which is part of the City's plans to link neighbourhoods and make them green. It aims to create a pedestrian and cycling network that connects people with the City and village centres as well as major transport and entertainment hubs, cultural precincts, parks and open spaces. The focus of the Liveable Green Network is active transport by making walking and cycling more attractive particularly for short trips, and a viable alternative transport choice to using the private motor vehicle. Improvements will include separated cycleways, lower speed limits,

widened footpaths and improved crossings. Cycling routes will be clearly marked with easy-to-read maps and signage. More seats, bubblers and bike parking will be built along major cycling paths. Green Square is included within this Network.

Integration of the walking and cycling infrastructure with public transport infrastructure is also important. Concerns outlined earlier about the adequacy of public transport to meet the needs of the growing population of Green Square may present a threat to true connectivity.

Conclusion

This report has shown that a well-connected transport system which maximises active and public transport and minimises private car transport has positive health impacts; while a heavy reliance on car transport and less use of active and public transport modes has significant negative health impacts. To contribute to the health of residents of Green Square, a built environment and transport infrastructure that encourages and enables walking, cycling, and use of public transport, and discourages private vehicle use, will therefore be important.

The findings of this report align with key strategies outlined by the World Health Organisation (WHO) to maximise health and climate gains from urban transport, reproduced below (see Table 1).

Table A3.1: 'Win-win' transport strategies to maximise health and climate gains [8]

Strategy	Key pathways
1. Land use systems that increase density and diversity of uses	• Increases proximity of destinations, reducing need for car travel and reducing VKT. • Improves access by walking, cycling and rapid transit/public transport.
2. Investment in and provision of transport network space for pedestrian and cycle infrastructure	• Improves access by walking and cycling. • Encourages shift from car use to walking and cycling, reducing VKT.
3. Investment in and provision of transport network space for rapid transit/public transport infrastructure	• Improves access by rapid transit/public transport. • Encourages shift from car use to rapid transit/public transport, reducing VKT.
4. Engineering and speed reduction measures to moderate the leading hazards of motorised transport	• Reducing speed improves safety of walking and cycling. • Increasing separation of vehicles from walkers and cyclists improves safety of walking and cycling.

	• Encourages walking and cycling by reducing safety barriers. • Technological improvements reduce production of hazards per vehicle (greenhouse gases, pollutants, noise).

VKT: vehicle kilometres travelled

It is recommended that the City of Sydney utilise the WHO findings and recommendations in the context of the Green Square redevelopment.

Already there are major challenges to achieving health-promoting urban transport mode targets in Green Square. It is unlikely that the 'no car growth' target for Green Square, along with targets for increased mode share for active and public transport will be reached, in the context of massive population growth, non-connected public transport which is already reaching capacity during peak times, poor walking and cycle path infrastructure outside the development, no nearby primary school for many residents, and new major road infrastructure.

Key strategies that are suggested to address these challenges and optimise the health impacts of the transport system for Green Square residents include:

- Confirm and secure a cross-government commitment to TMAP targets in relation to increased active and public transport mode shares and to no car growth for Green Square.
- Ensure walking and cycling infrastructure is accessible, safe and useable for all Green Square residents irrespective of age and ability.
- Ensure close proximity of key destinations including schools, shops, and leisure activities for all residents of Green Square, to promote active transport within the local area and public transport to further destinations.
- City of Sydney to achieve commitment from the NSW State Government for timely completion of the Sydney Rapid Transit project and delivery of adequate rail services for Green Square.
- City of Sydney to negotiate assistance from the NSW State Government to secure the Eastern Transport Corridor and commitment to deliver a new light rail service through that corridor.
- City of Sydney to secure commitment from the NSW State Government to increased routes and frequency of bus services in the Green Square Urban Growth Areas, noting that this is

an important and necessary measure but will not deliver the level of benefits that will accrue from rail and light rail.

- Focus on measures to discourage ownership and use of private vehicles by Green Square residents, including urban design and transport infrastructure that supports uptake of active and public transport; restrictive parking policies; and incentives to promote car-sharing.
- Consider other innovative economic incentives to encourage uptake of active and public transport, and to disincentivise private car ownership and use, based on global best practice. For example, strategies including car-free areas, employer incentives for active transport, road tolls and other road pricing strategies could be considered.
- Ensure full integration of walking and cycling infrastructure with public transport, to promote full transport connectivity.

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Appendix 4: Healthy Child Development Assessment Report

The significance of healthy child development

This assessment report examines available evidence relating to the impact of the built environment on healthy child development, in the context of increased urbanisation and urban density. It aims to inform planning for the City of Sydney Green Square development.

The built environment can have both positive and negative effects on healthy child development, and the design and implementation of healthy built environments in which young children can live, grow, and develop, has implications for health and well-being throughout the life course.

Healthy child development comprises multiple interrelated aspects including physical development, social competence, emotional maturity, language and cognitive development, and general knowledge and communication[1]. Children develop in multiple contexts including the family, peer group, and broader social and physical environments[2, 3]. These early influences affect schooling, socialisation, employability and ongoing full healthy and productive participation into adulthood[4, 5].

Development in the early years, particularly the first three years, lays the foundations and sets the trajectory for children's ongoing physical, social, emotional, and cognitive development [6]. It is therefore critical to set optimal child trajectories early in childhood, and address developmental vulnerabilities in children.

From birth, the brain rapidly develops through ongoing processes where important neural pathways supporting complex skills are built on simpler pathways. With age, brain plasticity solidifies, making it more difficult for the brain to rewire and learn new skills[7]. When children are exposed to stimulating and positive environments early in life, they develop foundational skills in learning, communicating, problem solving, and decision making[8, 9].

The built environment has the potential to either encourage or hinder physical activity, which is important for both physical and cognitive development. Children who undertake insufficient physical activity are more likely to become overweight or obese, placing them at higher risk for both

physical and mental chronic conditions throughout the life course. Environments that encourage regular physical activity are therefore a key aspect of supporting the health of the population.

The number of children living in higher density urban environments is increasing significantly. Urbanisation can bring advantages for adults, including easier access to services, social resources and infrastructure, reduced travel times, more opportunity for active travel, and community diversity and stimuli can be positives. Several of these factors can also have positive impacts for children. However, other factors such as limited exposure to open space, insufficient communal play spaces, higher traffic densities and anonymity can limit socialisation, exploration, physical activity and independence, potentially resulting in poorer physical and mental health and resilience in children.

Urbanisation and increased housing costs are also associated with social changes including unprecedented levels of family breakdown and discord, longer working hours, disconnection from extended family, cultural alienation and rising wealth inequality. These changes can have negative impacts on children's wellbeing[10].

Despite changing demographic profiles with higher proportions of families living in high-rise and higher density apartments, there has been little attention given to the impacts of high-density living on children and the infrastructure required to support them[11]. The majority of child development research has focused on the influence of individual, family and school environments or socio-economic status and has largely ignored the neighbourhood context[12]. Governments have historically underestimated the proportion of children living in new high rise developments in Sydney and consequently have not adequately planned for their needs. This practice has been called "Child Blind Planning"[11].

It has been noted that in Australia, "while the compact city plans do not explicitly exclude children, the logic of what is being planned will, under current settings, effectively result in a polarised city, one newly built in town centres and transport corridors for childless households, where the great growth in urban population is expected to come from, and the other, a suburban population in low density housing where families will be catered for"[13].

There is often an assumption that there will be few children in the high density development areas, with parents moving to other housing types once they have their second child. These families are often seen as professional couples in the process of family formation. However, while this may have applied in the past it may not apply in the future, as factors such as changing patterns of

workforce participation, housing affordability, cultural background, and attachment to the local area may affect housing preferences, or indeed the financial capacity of growing families to move to the suburbs.

The reality is that in Sydney in 2006, some 88,500 children (11% of all children) lived in flats across the city. This number and proportion can only be expected to increase over time. There are strong grounds for concern about how the lack of interior space, close proximity to neighbours, and poor open space provision impacts on children growing up in such environments, particularly their long-term physical development and well-being[13].

The needs of children in urban developments have two major components: the internal and external environments. This paper will explore the impact of both the internal living space, and the external neighbourhood environment, on healthy child development.

The City of Sydney Council ("the City") estimates over 7,000 children aged 0-17 will reside in Green Square by 2030[14]. An understanding of infrastructure and environmental needs to ensure children's wellbeing and healthy development is therefore essential, and must be central in planning by all levels of government and developers.

This report outlines the policy context for addressing child health in the context of urban development; explores the literature in relation to key health impacts of urban environments on child health and development; and analyses the implications for the Green Square development.

Policy context

Global policy context

The United Nations International Children's Emergency Fund (UNICEF) has spearheaded a global Child Friendly Cities movement. UNICEF describes Child Friendly Cities as being the embodiment of the UN Convention on the Rights of the Child at the local level, and defines a Child Friendly City as: "…a city, or more generally a system of local governance, committed to fulfilling children's rights, including their right to:

- Influence decisions about their city
- Express their opinion on the city they want
- Participate in family, community and social life
- Receive basic services such as health care and education

- Drink safe water and have access to proper sanitation
- Be protected from exploitation, violence and abuse
- Walk safely in the streets on their own
- Meet friends and play
- Have green spaces for plants and animals
- Live in an unpolluted environment
- Participate in cultural and social events
- Be an equal citizen of their city with access to every service, regardless of ethnic origin, religion, income, gender, or disability"[15].

The Child Friendly Cities approach has been piloted in three communities in South Australia but does not appear to have been taken up as yet in other Australian jurisdictions[16].

National policy context

Infrastructure Australia's document Our Cities, Our Future: A National Urban Policy for a Productive, Sustainable, and Liveable Future, 2011 represents the overarching national strategic framework for urban development in Australia[17]. While this policy does not include a specific focus on children or child health, several of its key objectives are highly relevant to the assessment of the potential impact of the Green Square development on healthy child development:

- Integrate land use and infrastructure (by integrating planning of land use, social and economic infrastructure, investing in urban passenger transport, and protecting corridors, sites and buffers)
- Protect and sustain our natural and built environments
- Reduce greenhouse gas emissions and improve air quality
- Facilitate the supply of appropriate mixed income housing
- Improve accessibility and reduce dependence on private vehicles (by improving transport options, and reducing travel demand by co-location of jobs, people and facilities)
- Support community wellbeing (by providing access to social and economic opportunity, improving the quality of the public domain, improving public health outcomes, redressing spatially concentrated disadvantage, and enhancing access to cultural, sporting, and recreational activity).

The Australian Government Department of Health does not have overarching policies for urban development and health, or for child health (as distinct from child health services). However the Department funded the Healthy Places and Spaces initiative which was a national program

between the Australian Local Government Association, the Planning Institute of Australia, and the Heart Foundation, for planning, designing and creating healthy built environments and sustainable communities. The project produced a manual to guide professionals in the health, planning and property development industries, community groups, and governments in healthy urban design to help tackle some of Australia's major preventable health issues, particularly by encouraging walking, cycling, and the use of public transport[18].

The Department has also produced National Physical Activity Recommendations for Children Aged 0-5 Years, as well as Australia's Physical Activity and Sedentary Behaviour Guidelines for Children (5-12 years) and a similar document applying to young people aged 13-17 years[19]. These recommendations and guidelines are relevant to this assessment, as urban design which either encourages or inhibits physical activity on the part of children and young people has a very significant impact on child health and development, and lifelong health trajectories. Each of these recommendations and guidelines stresses the importance of active play, and of children spending time outdoors, being independent and being able to explore their environments. Active transportation (walking and cycling) is also emphasised as important, particularly for children aged 5 years onwards.

State of New South Wales policy context

The NSW Government has indicated its appreciation of the relationship between built environments and health, acknowledging the strong evidence demonstrating the links between chronic disease and lifestyles characterised by car-dominated transport, reduced opportunities for exercise, increased fast food availability and lack of social connection; and developing strategies to address physical activity opportunities, healthy food access, and opportunities for social and community interactions[20]. Key policy documents developed by the NSW Government which are relevant to these issues include the *Healthy Urban Development Checklist*[20] and the *NSW Healthy Eating and Active Living Strategy 2013-2018*[21]. Active living was also promoted by the Premier's Council for Active Living, but this initiative was discontinued in 2016[22].

The NSW Government in December 2014 published *A Plan for Growing Sydney,* a new overarching strategic plan for Sydney for the next 20 years. The strategy prioritises intensive development of several strategic locations within Sydney, including Green Square, with growth in these locations seen as critical to sustaining and expanding the economy and supporting more jobs closer to where people live[23].

The *NSW Strategic Plan for Children and Young People 2016-2019*[24] is based on broad consultation including with significant numbers of children and young people, and covers a range of themes which are relevant to healthy child development in urban environments. The goal of the plan is that children and young people in NSW are safe, connected, respected, healthy, and well, with opportunities to thrive and have their voice heard in their communities. The focus on connectedness is particularly relevant to the Green Square development. The plan notes (p.16) that a sense of belonging and connectedness to others is critical to the wellbeing of children and young people, and refers to the importance of community projects and activities to foster community engagement, build community harmony and social cohesion and celebrate cultural diversity; and the importance of safe and accessible transport networks including roads, trains, buses, cycleways, and footpaths to support children and young people's connection to work, learning and leisure[24].

The NSW Department of Health has released *NSW Kids and Families Healthy Safe and Well: A Strategic Health Plan for Children, Young People and Families 2014-2024*[25]. The plan focuses on preconception to 24 years of age, setting out an agenda for renewed efforts to promote health, prevent illness, embed early intervention and deliver integrated, connected care for all NSW children and families. The five strategic directions in the plan are: caring for women and babies; keeping children and young people healthy; addressing risk and harm; early intervention; and right care, right place, right time. The plan does not explicitly discuss the impacts of physical environments and urbanisation on child and family health, but does refer to the need (Strategy 2.1.1) to promote healthy eating and active lifestyles in families, schools, and communities; and one of the key indicators of progress is a reduction in the percentage of school children who are overweight or obese.

The *Inner West Sydney Child Health and Wellbeing Plan 2016-2021* was jointly developed by the Sydney Local Health District, the NSW Department of Family and Community Services, the Central and Eastern Sydney PHN, the NSW Department of Education, and the Inner West Sydney Collaborative Practice Management Group[26]. The Green Square urban growth area is included within the boundaries of this plan, and the plan recognises that good health and wellbeing in the earliest years provides the basis for positive health status in adolescence and adulthood. The plan focuses on cross-agency collaboration to address four strategic areas: improved system capacity; health and wellbeing promotion; early intervention; and supporting place-based approaches. The impact of urban development on child health and wellbeing is discussed in the plan. It is noted that while high density living can bring benefits including proximity to services, walkability, physical security and viability of material resources, unmitigated dense urban built environments can present

risks to health and wellbeing including respiratory illness, traffic accidents, negative mental health outcomes, and reduced opportunities for active play for children. The plan notes that managing and mitigating the environmental, social and health opportunities and risks of population growth requires integrated planning to ensure the creation of socially, environmentally and economically sustainable communities. Relevant initiatives identified in the plan are the development of consistent public health strategies, programs and messages around priority topics, with a major priority being childhood obesity, nutrition, and physical activity; and collective advocacy for the inclusion of health promoting, active, child friendly urban spaces and adequate child-related services in areas of future high levels of urban growth and development in Inner West Sydney.

City of Sydney policy context

At local level, the City's Sustainable Sydney 2030: The Vision sees the southern part of the city including Green Square as an opportunity for considerable growth, infrastructure improvements, and redevelopment to contribute significantly to Sydney's sustainability[23].

In March 2015 the City released the Green Square Draft Infrastructure Strategy and Plan, which sets out in detail the history of the site, the current status of development, and plans for the future. While the document discusses a number of key aspects of the development – street and transport systems, public domain, and social infrastructure – which have implications for healthy child development, it does not use a health lens in discussing these matters, and children are not highly visible in the plan.

The City also has a number of other plans which are relevant to the following assessment of child health impacts of the Green Square development, including a Walking Strategy and Action Plan, and as Cycle Strategy and Action Plan which provides for a network of safe, connected, separated cycleways to accommodate the future demand for cycling likely to be generated by development[27].

Potential health impacts of the urban environment on child health and development

The population of interest

The Green Square and City South Village estimated resident population in 2011 was 20,013 people, and this is projected to grow to at least 54,170 by 2030[28] – note that latest figures on the City of Sydney Green Square website now put this estimate at 61,000)[29]. While 58.3% of households in 2011 were comprised of either couples without children or lone persons, there is nevertheless a significant and growing number of children in the area: 9.9% of the population were

children aged 0-14 (1,992 children), higher than the overall City of Sydney average of 7.1%. This figure is expected to increase to at least 7,000 by 2030[23].

Demographic data indicate a culturally diverse population, with 53.4% of Green Square and City South Village residents born overseas, and 41.8% coming from countries where English is not the first language. The three top ranking countries of birth were Australia, Other Asia, and China (including Hong Kong). At home, 45.7% of residents speak a non-English language either exclusively, or in addition to English – far higher than the average of 34.4% for the City of Sydney overall [28].

The literature in relation to key potential impacts of urban environments on healthy child development is explored below, following which the implications of each of these issues for the Green Square development will be discussed. The literature review focuses on six key areas of healthy child development that may be impacted by urban development and density:

- Participation in active transport (walking and cycling)
- Participation in outdoor play and exploration
- Exposure to traffic and air pollution
- Access to high quality local schools
- High density living, including high rise developments
- Poor quality housing and overcrowding.

The literature review does not include in its scope several other potential influences on healthy child development which may be relevant to the Green Square development, including socio-economic status and ethnicity of residents; access to health care services (noting there is currently no children's health service within Green Square and City South Village); access to healthy food; and social infrastructure.

Impacts of urban environments on children's participation in active transport

Regular physical activity is essential for healthy child development. It helps maintain a healthy body weight and provides an opportunity for children to socialise and develop physically. Being overweight is a risk factor for poor health later in life including a higher risk of developing chronic disease such as diabetes and cardiovascular disease, and some cancers. A sedentary way of life is also a risk factor for mental health problems such as depression.

The Australian National Children's Nutrition and Physical Activity Survey, undertaken in 2007, showed that approximately 17% of 2-16 year old children were overweight, 6% obese and 5%

underweight. Only one-third of children, and one in ten young people undertook the recommended 60 minutes of physical activity every day and fewer than one in three children and young people (5-17 year olds) met the "no more than 2 hours of screen-based entertainment" recommendation every day[30]. There is no reason to assume that these statistics have improved in the past decade.

Reduced rates of physical activity are contributing to rising rates of overweight and obesity, and mental health problems[31]. Obese children are more likely to have:

- high blood pressure and high cholesterol, which are risk factors for cardiovascular disease;
- prediabetes (impaired glucose tolerance, insulin resistance) indicating a high risk for development of diabetes[32];
- breathing and sleep problems such as sleep apnoea and asthma;
- bone and joint problems; and
- social and psychological problems such as stigmatization and poor self-esteem [32, 33]

Urban environments can have either positive or negative impacts on children's physical activity levels, and the consequences for physical and mental health are clearly significant. Key elements of the built environment which can impact on children's physical activity levels and development include[12]:

- Walkability and cyclability: Children who live in neighbourhoods with well-connected streets with safe crossing points, child-friendly footpaths and cycle paths, interesting destinations, and low traffic volume and speed, are more likely to be physically active, and walk and cycle to destinations (including school) when compared to children who live in less walkable neighbourhoods.
- Perceptions of safety: Parents' perceptions of safety are highly important in influencing the extent to which children are able to move independently around their neighbourhood. This includes both perceptions of physical safety in relation to issues such as road traffic, and perceptions of personal safety in terms of concerns around "stranger danger". Road traffic controls can help to address concerns about physical safety, and neighbourhood and building design that enables parents to observe and monitor children's activities helps to increase perceptions of surveillance or "eyes on the street", which can to some extent allay the latter concerns.
- Proximity to local destinations: Planning that ensures that destinations such as schools, shops, and recreational facilities are located within walking distance of housing developments will promote physical activity, as well as promoting use of the destinations.

- Access to outdoor recreation spaces: Green spaces including parks, playgrounds and particularly natural spaces, have been consistently shown to be important for healthy child development. This is discussed further in the next section.

Active transport (walking and cycling) is strongly encouraged in physical activity guidelines because it builds physical activity into day-to-day life, making it more likely that healthy levels of activity will be reached on a regular basis. Active transport has positive impacts not only on physical activity levels, but also on other aspects of child development. Children's physical development is closely associated with their broader social, emotional, and cognitive development. As children grow older and become more mobile, those with access to safe, well connected streets have greater opportunities to acquire the basic skills to interact with and move through their neighbourhood. Children in such environments have opportunities to problem solve, to manage risks and negotiate traffic situations by judging traffic speed, interpreting traffic signs and crossing roads, to learn about their environment, and to improve their spatial and wayfinding abilities such as distance estimation, locating north, identifying landmarks, and spatial referencing skills [34, 35]. Such skills are vital for children's healthy cognitive development, and to build children's confidence and competence to safely interact with their environments[35, 36].

It has been shown that children (and parents) are more likely to use destinations and services located within walking distance of their home [37, 38]. Time and distance, along with safety, are key factors that influence whether children or adolescents walk or cycle for transport to school or other destinations[39, 40].

Local destinations, infrastructure and services become increasingly important as urban density increases[41, 42]. Clearly destinations such as schools, recreation venues, and child care and health care services all have inherent functional roles, but they can also offer opportunities for social interaction and the development of local support networks[43]. Ready access to such destinations can positively influence children's development through providing opportunities to learn, explore, recreate, socialize, and interact[44, 45].

Impacts of urban environments on outdoor play and exploration

A generation ago, children were far more likely to play independently in their own neighbourhood than they are today. More children are living in high density housing and as noted above, there is evidence to support the contention that features of the built environment (such housing density, street design, traffic exposure, and access to parks) can affect child development, and children's

mental and physical health. Of particular concern are environments that restrict children's physical activity, independent mobility, and active play[46].

An increase in the number of children in an urban area will in turn increase the need and demand for appropriate safe spaces for recreation. As urban density increases, access to local services can improve; however, access to green spaces and nature often declines [47]. Playing outdoors supports contact with nature, which affects children's restorative experiences and emotion regulation, as well as cognitive functioning such as attentional capacity and self-discipline[48-50]. Natural play environments with elements such as trees, plants, and flowers appear better for children's cognitive and physical development than physical man-made play areas[51]. Children who play in natural areas engage in more physically demanding play, demonstrate better gross motor skills such as climbing, balance, and coordination, have increased attention spans, and experience fewer sick days at day care centres compared to children who play in purpose-built playgrounds [52].

Regardless of age, sex, or socioeconomic status, some children will travel further than their closest park to visit more attractive parks with appealing attributes, such as better play equipment or areas with better streetscape[53]. Provided they are safe, playgrounds should offer a range of activities and some level of managed risk; otherwise, children perceive these structures as "unexciting and unchallenging" which decreases the likelihood that they will use them[54-56].

An understanding of children's preferences for spaces and places across the age spectrum can inform neighbourhood planning and the development of facilities that entice use, and influence child health and development. Access to better-quality destinations is particularly important for children living in geographically disadvantaged areas. Studies generally suggest that more deprived areas may have access to poorer-quality parks, services, and destinations than more affluent areas[57, 58].

Health impacts of traffic and air pollution

High density environments are often characterized by high traffic exposure, and this can have direct negative health impacts on child health due to air pollution and motor vehicle accidents; as well as indirect negative health impacts, as high traffic levels can lead to reduced physical activity due to walking and cycling being perceived as less safe for children.

Parents' and children's concerns about risk of traffic injury are well founded. Younger children appear to be more at risk of traffic injury than older children[59]. Children aged ten and under often lack the cognitive abilities including attention focus and interpreting traffic signs, and perceptual

abilities such as locating sounds, judging speed, and peripheral vision, to negotiate complex traffic situations[60].

Traffic speed and volume, the availability and design of controlled crossings, the extent of illegal or dangerous parking, visibility levels, and levels of supervision at pedestrian crossings are safety factors consistently associated with the extent to which children are allowed to play and interact with their neighbourhood[61]. Low traffic exposure has been shown to be a key contributor to neighbourhood safety[62].

Higher levels of traffic exposure have been associated with parents restricting children's outdoor activities, smaller social networks, poorer academic performance, and diminished social and motor skills[63-65]. On the other hand, cul-de-sac ("lollipop") networks have been found to encourage young children's play and generate informal social control by neighbours[66].

Higher-density housing is frequently located along major arterial roads, which attract more vehicular traffic and strangers into the local area[42]. Parental concerns about traffic and strangers are among the most highly cited barriers to children's engagement with the outdoors[67, 68]. Research has demonstrated that children living in high-rise housing were also concerned about traffic volumes and lack of safe crossing points in their neighbourhood[69]. Neighbourhoods need to be designed in a way that provides safe routes for children by separating them from high-traffic main streets[42], yet also provides freedom and ease for children to safely move around the neighbourhood independently, including shorter distances to destinations.

Air pollution is a major but poorly recognised cause of ill health and mortality, particularly among children. Major sources in urban environments are motor vehicle emissions, wood smoke from home heating and bushfires, industrial pollution, and diesel vehicle emissions[70].

In typical urban air pollution situations, particulate matter and gaseous pollutants (oxides of nitrogen, ozone, carbon monoxide and "air toxics" such as hydrocarbons and aldehydes) occur together, as the sources are the same. Levels of pollutants can vary dramatically by location and over time, depending on changing meteorological factors such as wind speed and wind direction[71]. In New Zealand, an estimated 900 deaths per year are attributable to air pollution (2% of all deaths), of which nearly half are due to motor vehicle emissions[71]. Similar estimates have not been developed for Australia.

The known health impacts of air pollution are serious, particularly for people more susceptible to short-term exposure to even low levels of pollutants. Very small particles penetrate further into the lungs than larger particles, and are more strongly associated with adverse health effects. Diesel engine emissions are a significant risk as they are high in ultrafine particles and contribute disproportionately to the very-small-particle fraction of urban air pollution. Because of their small size, these particles can be inhaled deeply into the lungs and deposited in the alveoli. Diesel particulate has been classified as a carcinogenic (cancer causing, particularly lung cancer) by the World Health Organisation[72].

Children's exposure to air pollution is a special concern because their immune system and lungs are not fully developed. Their substantive risk for respiratory problems is greater, especially in impacting on lung growth, and exacerbating diseases for those with underlying chronic respiratory conditions such as asthma, ranging from minor respiratory symptoms to increased hospital admissions and mortality[71]. Pollution also stimulates atopy, which is a tendency to develop allergic diseases such as allergic rhinitis, asthma and atopic dermatitis (eczema), typically associated with heightened immune responses to common allergens, especially inhaled allergens and food allergens[73]. Prenatal exposure to air pollution is associated with early fetal loss,-preterm delivery, and lower birth weight[71].

A large amount of illness and mortality could be avoided through emission-control strategies, which have improved in recent years, for example through improved fuels and pollution-control technology for cars; and through increased public transport use and thus reduced car use[70].

Health impacts of access to local schools

Access to high quality education is vital for the cognitive and social development of children, influencing future health, social and employment outcomes[12]. Areas of high density housing commonly have less schools and of lesser quality than less dense neighbourhood [12]. Reasons for these differences are twofold. Firstly, urban regeneration commonly occurs in industrial areas where there was previously no need for nearby schools, hence the existing education infrastructure is not in place[74]. Secondly, based on past demographic information, governments and developers frequently underestimate the proportion of families living in inner city developments, as these have previously been the territory of young professionals without children[74].

Access to good local schools has been identified as one of the critical features that current high density neighbourhood and building design need to take into consideration into their planning[12, 62].

The proximity of a child's home to their school affects the amount of time spent with families [41] and is predictive of children's level of physical activity[62]. In the US, McMillan[75], found that children were more likely to engage in active transport – walking or cycling – to school if the school was within one kilometre of their home and the path was reasonably walkable. In other research, parents have reported that a round trip of 1.6 km (i.e. 800 metres one way) is an acceptable walking distance to accompany primary-school-age children[76, 77]. As children grow older and become more independent, they are more likely to walk or ride to destinations including schools if these are close and located along a safe route, for example a route with dedicated walking and cycling paths, and lower traffic volumes and speeds.

Impacts of high density living, including high-rise developments

The potential interactions between urban density and child development are complex; they are likely to be affected by socioeconomic disadvantage and mediated by the influence that density has on parent mental health, neighbourhood satisfaction, and perceptions of the environment[46]. Where higher-density living does not adequately cater for child development, negative outcomes may manifest as behavioural problems, social withdrawal, and poor academic performance[78].

Satisfaction related to the built environment is often linked with perceptions of the neighbourhood, including safety[79, 80]. Neighbourhood safety concerns may influence family practices and parental restrictions, thereby affecting children's opportunities to play outside and interact with others locally[67, 81]. For example, Evans and Ferguson[78] found that mothers of young children living in high-rise developments had difficulty monitoring their children's outdoor play, which led to reduced opportunities for children to play outdoors due to parents' concerns regarding crime and safety[78].

High-rise living (buildings of four or more stories), and particularly renting have been associated with poorer adult mental health outcomes and neighbourhood dissatisfaction, regardless of socioeconomic status[79, 80, 82].

Space is particularly critical for families shift living in higher density developments. New high rise apartments are being heavily marketed at the childfree life stylers (either pre- or post-children) and children have historically been significantly under-represented in this kind of property. However, with decreasing housing affordability and changing socio-cultural patterns, flats are increasingly housing children[83].

Where high-density developments consist entirely of one- and two-bedroom units, with inadequate provision for families and extended families, they cannot be said to be family-friendly. A study of a high density urban neighbourhood in Sydney found that the limited number of rooms in high density developments, especially for larger families, is likely to lead to overcrowding problems. Often this might be inter-generational, with three generations sharing a small flat. Shift and night working is a problem with young children who will be expected to remain quiet while the working person sleeps. The same was also true if the parent works at home. High density environments often require children to be under strict supervision inside the home, to avoid them making noise that might disturb neighbours and others in the flat. The use of the lounge room for sleeping was also another issue which had serious implications for children. The research noted that lack of space and the need to keep children quiet appeared to lead to parenting that emphasised activities that were sedentary, such as keeping a baby on a dummy or providing feeding bottles whenever it made noise, and crawling and walking being stymied due to space problems with very young children having little access to areas for meaningful activity[11]. All of these factors have potential negative consequences for healthy child development.

Access by families to social infrastructure, including public facilities that are suitable for and needed by families with children, is also important in ensuring the social and emotional wellbeing of families living in high-density housing.

Health impacts of poor quality housing and overcrowding

Aspects of housing that have been empirically identified as influencing physical health include environmental allergens, toxicants, cleanliness, housing disrepair and safety, building height and opportunities for outdoor play, crowding, housing affordability, home ownership, frequent residential moves, homelessness, and neighbourhoods. Poor building quality and poorly maintained housing can have negative health impacts in areas including infectious disease, respiratory disease, asthma, eczema, hypothermia, and heart disease[84].

An Australian Housing and Urban Research Institute study[85] examined the literature on the relationship between housing and health, and concluded that poor housing has a clear negative impact on residents' health, although the illnesses tend not to be among the most serious. The most significant impacts result from cold, dampness and mould. The study found that poorly designed housing predisposes accidents such as falls and burns, with children and the elderly being particularly affected.

Poor housing affordability (and inadequate housing size) can contribute to overcrowding which impacts on stress levels and spread of infectious diseases[86].

Housing design also affects child development, with adequate space, insulation from noise, and protection from weather extremes being particularly important.

Summary of potential key health impacts of urban development in relation to healthy child development

Potential health impact	Likelihood	Severity	Populations impacted
Inadequate opportunities for active transport (walking and cycling), leading to reduced physical activity levels in children, resulting in: - Higher levels of overweight and obesity - Mental health problems - Less opportunity for children to develop skills and independence.	Highly likely in neighbourhoods with: - Reduced levels of safe walkability and cyclability for children and families - Lack of proximity of housing to key destinations such as schools, shops, playgrounds recreational venues.	Reduced physical activity and overweight and obesity in children has severe lifelong health implications including higher risks for: - Type 2 diabetes - Cardiovascular disease - Some cancers - Breathing and sleep problems - Bone and joint problems - Depression and other mental health problems.	Children living in neighbourhoods which are relatively lacking in safe active transport routes, and lack key destinations in close proximity to family homes.
Inadequate opportunities for outdoor play and exploration, leading to reduced physical activity levels in children, with health impacts as listed above.	Highly likely in neighbourhoods with reduced access to open space/green space/playgrounds/natural spaces.	Severe health impacts as listed above. In addition, lack of stimulating play has implications for cognitive development.	Children living in neighbourhoods which are relatively lacking in suitable open spaces.
High exposure to road traffic and air pollution (particularly arising from road vehicle emissions).	Highly likely where urban populations expand rapidly in areas already characterised by high traffic volumes and congestion, with inadequate mitigation. Risk is very high along major traffic routes, and particularly routes used by heavy vehicles emitting diesel particulate.	High traffic levels can: - Reduce safe walkability and cyclability for children, contributing to the severe health impacts of reduced physical activity - Put children at risk of motor vehicle accidents - Increase air pollution.	Children living in areas with high traffic volumes and speeds; children of mothers living close to sources of air pollution, particularly roads with high traffic volumes and high emissions, during pregnancy.

		Severe potential health impacts of air pollution for children including reduced lung development, exacerbation of asthma and bronchitis, and allergic diseases. Increased hospitalisation and mortality. Prenatal exposure to air pollution is associated with early fetal loss, preterm delivery, and lower birth weight.	
Poor access to high quality schools in the local area.	Highly likely if the projected growth in the population of children in a neighbourhood is not matched by a growth in places available in high quality schools in the local area.	Quality of schooling affects future health, social and employment outcomes. Lack of proximity of schools reduces time spent with families due to longer commutes to school, impacting on family wellbeing; and reduces physical activity levels as children and parents are less likely to walk or cycle to schools that are more than about one kilometre from home, contributing to severe health outcomes as listed above.	Children and families with no access to a suitable high quality school within a one kilometre radius.
Negative mental health impacts of high density and high-rise living.	High if development requirements, building design, and social infrastructure fail to cater for the needs of children and families.	Potential impacts on child development which arise from lack of adequate space and lack of safe outdoor play opportunities include reduced physical activity, behavioural problems, social withdrawal, and poor academic performance.	Children and families living in high-density housing, particularly high-rise housing, which has not been designed to adequately meet the needs of families with children.
Health impacts of poor quality housing and overcrowding.	High if housing is poorly designed, poorly built, poorly maintained, or insufficiently affordable. The most significant	Negative health impacts of poor building quality and poorly maintained housing include	Children and families living in poorly designed, poorly built, poorly maintained, or insufficiently affordable housing.

	impacts result from cold, dampness and mould, and poorly designed housing which predisposes accidents. as falls and burns, with children and the elderly being particularly affected.	increased risk for infectious disease, respiratory disease, asthma, eczema, hypothermia, heart disease, and accidents such as falls and burns. Overcrowding impacts on stress levels and spread of infectious diseases.	

Implications for Green Square development

In relation to the key areas of risk to healthy child development covered in this report, the implications for the Green Square development are as follows.

Opportunities for active transport

This report has noted that reduced rates of physical activity are contributing to rising rates of overweight and obesity and mental health problems among children. Active transport – walking and cycling – is an important strategy for increasing physical activity and for overall child development, including cognitive development. The ability for children and families to walk and cycle safely around the neighbourhood requires well-connected streets with safe crossing points, child-friendly footpaths and cycle paths, interesting destinations, and low traffic volume and speed. Planning that ensures destinations such as schools, shops, and recreational facilities are located within walking or cycling distance of housing developments is also important.

The City's *Green Square Draft Infrastructure Strategy and Plan*[23] discusses streets and transport systems in detail (summarised further below under "Health impacts of road traffic and air pollution"). It is clear that the delivery of an adequate public transport infrastructure to meet the needs of Green Square residents and businesses will lag well behind the rapid pace of development. This will almost certainly mean a continued significant growth in road traffic volumes, which will impact not only on traffic congestion on key strategic corridors, but on amenity and health for residents of Green Square.

There will be significant challenges to achieving neighbourhoods which are safe for children to walk and cycle around, in the context of high and increasing traffic volumes. The City's strategy does aim to increase walking and cycling, and includes widened footpaths to achieve improved

pedestrian amenity, pedestrian crossings on all approaches at each signalised intersection, cycle paths including some separated cycleways, and reduced speed limits in the town centre[23].

However the City acknowledges there are key risks that arterial roads compromise pedestrian movements and amenity, particularly around the Green Square train station; and increased congestion on arterial roads means that traffic passing through Green Square may use local/neighbourhood roads. It is also unclear whether the aim of the cycle strategy to "allow people of all bike-riding ability to choose to use a bicycle to safely travel through Green Square and the adjacent neighbourhoods" will be achievable for children, given that the cycleways will be a mix of dedicated lanes, shared paths with pedestrians, shared zones and contraflows[23].

It is suggested that to ensure adequate opportunities for active transport for children residing in Green Square, priority needs to be given to walking and cycling paths which are well separated from motor vehicle traffic; low traffic speeds, supervised crossing points, and other traffic-calming measures to ensure the ability for safe road crossings; and planning that ensures all residents have access to key destinations within a one-kilometre walk/cycle of their homes.

Opportunities for outdoor play and exploration

This report has cited evidence that outdoor play and exploration is a critical element in the physical and cognitive development of children, and is important in maintaining good physical activity levels and a healthy weight. Ready access to outdoor recreation spaces, including parks, playgrounds and natural spaces is vital to facilitate this.

The City generally relies on development to provide smaller local parks. The planning controls for Green Square identify new open spaces which will bring the total open space to 215,00 square metres, or 3.95 square metres per person (with the increased 2030 population estimates, this reduces to 3.5 square metres per person), not including the regional open spaces of Moore Park or Sydney Park which are noted as being difficult to access due to surrounding arterial roads with high traffic volumes. The City notes that the new parks which have been delivered through planning agreements with developers are very popular and well used, but their relatively small size means they are generally used for predominantly passive recreation. The City recognises that several neighbourhoods are well under-provided with open spaces, that more open spaces will need to be created in Green Square and that the existing open spaces will need to "work harder" to meet the demands of the growing population; and the City is investigating options for the further delivery of open space, particularly in the southern precincts. Note that construction is commencing 2017 on

Gunyama Park in the Epsom Park neighbourhood, which will include an aquatic centre, a multi-purpose sports field, and a range of recreation activities. The City is undertaking further work to understand and address the open space needs of the population of Green Square [23].

The nature of the external environment is crucial for healthy child development. Features to be considered for the Green Square development include: spaces that allow development of gross motor skills; spaces that are pet friendly; public and private playgrounds; high levels of security; wild spaces with opportunities for children to explore nature; opportunities for structured and unstructured play; spaces that cater to different developmental stages; creative spaces; meeting spaces; and public infrastructure such as libraries. Measures to ensure that all residents have access to open spaces within one kilometre of their homes need to be considered; these might include, for example, higher requirements on developers to provide local parks.

Health impacts of road traffic and air pollution

This report has noted that high traffic exposure can have direct negative health impacts on child health due to air pollution and motor vehicle accidents; as well as indirect negative health impacts, as high traffic levels can lead to reduced physical activity due to walking and cycling being seen as less safe for children. Air pollution is a major but poorly recognised cause of ill health and mortality, particularly among children, and that motor vehicle emissions are a major source. Children's exposure to air pollution is a special concern because their immune system and lungs are not fully developed, and their substantive risk for respiratory problems is greater.

Key mitigating factors include reduced traffic speed and volume, including through the encouragement of public transport; well designed and well controlled crossings, including supervised crossings; well-designed parking; good visibility levels; safe routes for children that separate them from high-traffic main streets, and promote their safe movement around the neighbourhood; and emission-control strategies.

Managing traffic will be an enormous challenge for the Green Square development. Major roads surrounding and intersecting Green Square are extremely congested during peak times and weekends. Car use is projected to increase significantly as the local population triples over the next 15 years. The construction of the Westconnex Motorway will contribute to deteriorating air quality as roads such as McAvoy Street are widened to allow more vehicles to exit locally.

The City's *Green Square Draft Infrastructure Strategy and Plan* [23] acknowledges that studies indicate the road network will likely operate at or close to capacity, and that unless transport demand generated by Green Square's development is concentrated around high capacity public transport infrastructure, the road traffic generated is likely to severely congest key strategic corridors. The Plan emphasises the need to increase the proportion of trips taken by public transport and active transport, and to minimise car trip generation from current and new residents and businesses. The Plan also notes that public transport is the responsibility of the NSW Government rather than the City; and discusses the roles of the City and the NSW Government in developing and updating an agreed Transport Management and Accessibility Plan for Green Square.

As noted earlier, it is clear from information provided in the Plan that the delivery of an adequate public transport infrastructure to meet the needs of Green Square residents and businesses will lag well behind the rapid pace of development. The almost certain outcome is continued significant growth in road traffic volumes, which will impact on amenity and health for residents of Green Square, including children.

In relation to healthy child development, the challenge will be to find ways to ensure that children living in Green Square can walk and cycle safely, and that measures are in place to address the health risks arising from air pollution from vehicle emissions, in the context of increasing volumes of road traffic. As noted earlier, separated walking and cycling paths, low traffic speeds, supervised crossing points, and other traffic-calming measures will be important. In addition, there may be opportunities to work with the NSW State Government to accelerate the development of the public transport network to meet the growing needs of Green Square commuters. At City level, incentives could be considered to encourage Green Square residents to use public or active transport, and to utilise car-sharing schemes, and discourage use of private motor vehicles.

Access to local schools

This report has noted that access to high quality education is vital for the cognitive and social development of children, influencing future health, social and employment outcomes. The proximity of a child's home to their school affects the amount of time spent with families, [41] and is predictive of children's level of physical activity, as children and parents are more likely to walk or cycle to schools that are within about one kilometre of home.

An *Essential and Social Infrastructure Plan* commissioned by the City has assessed school requirements for Green Square [87]. The report notes that there is one primary school located within the Green Square and City South Village boundary (Gardeners Road Public School). There are also two other schools in the Green Square catchment area: Alexandria Park Community School, and Bourke Street Public School. Based on a benchmark of one primary school per 500 students, and based on the assumption that every child in Green Square and City South Village attends a public primary school, the report found that at least one new school is required immediately and four new schools will be needed by 2031.

The provision of public schools is a state government responsibility. The NSW Department of Education and Communities has advised the City that it has capacity in existing buildings to accommodate projected increases in primary school student enrolments for at least the next 10 to 12 years, including through expansion of these premises.

Notably, the Department is redeveloping Alexandria Park Community School to cater for up to approximately 1,000 primary school students and up to approximately 1,200 secondary school students. The redevelopment will deliver significant upgrades, improving the facilities and ensuring the school can cater for the increasing student enrolments from Kindergarten to Year 12[88].

The *Essential and Social Infrastructure Plan* found that high school students are better provided for; and that based on the benchmark of one school per 1200 students, by 2031 Green Square will require either another high school, or an increase in capacity for the local Alexandria Park Community School, which currently has a capacity of 320 to 370 students[87].

The expansion of capacity in the three existing schools in the Green Square enrolment catchment area, two of which are outside the precinct, clearly will not ensure that all primary school aged children in Green Square will have access to a local school within walking/cycling distance of their homes. This will present major barriers to active transport to and from school, and will increase traffic problems around existing schools, all impacting on healthy child development. It appears from these findings that it will be a priority for the City to work with the NSW State Government to ensure the provision of sufficient high quality local primary schools, within easy walking/cycling distance of people's homes, throughout Green Square.

It is also of concern that currently the only out-of-school-hours care available locally is at Gardeners Road Public School, which can cater for 60 children after school and 45 children before school. Given the projected increase in the numbers of young children living in Green Square, and the high

levels of adult employment, demand for out-of-school-hours care can be expected to increase, and measures will be needed to meet this demand.

Impacts of high density living including high-rise residential developments

This report has cited evidence that where higher-density living does not adequately cater for child development, negative outcomes may manifest as behavioural problems, social withdrawal, and poor academic performance.

Key measures to mitigate this risk include requirements for developments to include apartments of sufficient size and amenity for families with children to live comfortably; building design which allows parents to visually monitor their children's safety, including in high-rise living settings, enabling children to spend time outside and socialise with others; and access to social infrastructure including facilities suitable for families with children.

The nature of the living space is important. Some issues to be considered include: building living areas large enough for children to play inside; security on verandas and windows to prevent accidents; wall thickness that does not mean children are constantly being made to be quiet; adequate heating and cooling systems; lifts that are large enough for prams and bikes, and are kept in good repair so they are consistently able to be used; appropriate provision for parking; stairwells that are clean and safe; design that limits opportunities for small children to be able to leave the building without adult assistance; and storage space for bicycles, scooters and are large play items.

It is also important to consider the family living patterns of the high proportion of the Green Square population who were born in South East Asia and China, and the large numbers who speak Chinese at home. Grandparents and particularly grandmothers play a key role in many ethnic Chinese families with young children, often caring for them in their first year or more of life so that mothers can return to work, even if this means moving to Australia from overseas for an extended period. The size and design of dwellings should be inclusive of extended family structures, and the social infrastructure should cater to these older people who are unlikely to speak English and are in danger of becoming socially isolated.

As recommended in relevant guidelines, building design should maximize the potential for adults to supervise children at play. This includes visual access for the parent or caregiver, preferably from the unit; natural surveillance from other overlooking units and common areas; and a direct and unobstructed route between the family units or observation point and the common play area. The

potential to supervise play from the unit must be combined with a common outdoor open space that is secure and semi-private, otherwise small children often will not be allowed out into it by themselves. Ideally, each family unit should have both visual and direct physical access to at least one common play area for small children. To achieve this, design solutions such as play lounges, observation corridors to allow visual access to the common play area, roof terrace play areas, and enlarged balconies could be considered [89]. The City could consider requiring developers to include such features in new developments.

The City acknowledges that facilities catering to working families with young children will be particularly critical in the Green Square development, including libraries, child care centres, early childhood health centres, and aquatic and recreation facilities. The City raises particular concerns about potential for the increasing demand for child care services to continue to significantly outstrip supply. The City has prioritised several areas for facilities and service provision: child care; integrated community hubs; cultural/creative facilities; indoor recreation facilities; library; and spaces and infrastructure for night time events[23]. Such facilities are likely to be of value in promoting the social and emotional wellbeing of families with children living in high density housing. Other services likely to be important for these families, including schools and children's health services, are the responsibility of the NSW state government.

It is suggested that the City focus on planning provisions for Green Square that require a mix of residential sizes and styles, including building design appropriate for families with children and extended families, to ensure the development is more child-friendly. A focus on community development resources and initiatives that are inclusive of families with children will also be essential.

Impacts of poor quality housing and overcrowding

This report has noted that poor building quality and poorly maintained housing can have negative health impacts in areas including infectious disease, respiratory disease, asthma, eczema, hypothermia, and heart disease. Poorly designed housing predisposes accidents such as falls and burns, and children are among those particularly vulnerable. In addition, poor housing affordability (and inadequate housing size) can contribute to overcrowding which impacts on stress levels and spread of infectious diseases. Housing design also affects child development, with adequate space, insulation from noise, and protection from weather extremes being particularly important.

The *Green Square Draft Infrastructure Strategy and Plan*[14] focuses on the external environment rather than the internal environment that people live in. That is, it does not discuss issues of housing design and quality in any detail. This is largely a matter for developers, who must work within relevant legislation and regulation. In building residential homes, the building industry in NSW must comply with the *Home Building Act 1989 (NSW)* and the *Home Building Regulation 2014 (NSW).* In addition, the City of Sydney approves and controls building activity on private land and public spaces within the City. These statutory functions include inspecting building works as the principal certifying authority to ensure regulations, building codes and standards are compliant.

As outlined above, it will be important that the City focus on planning provisions for Green Square that require a mix of residential sizes and styles, including building design appropriate for families with children and extended families, to ensure the development is more child-friendly. In addition, it is suggested that the City of Sydney pay particular attention to issues of building quality and maintenance, and housing affordability, to minimise the risk of poor quality housing and overcrowding impacting on healthy child development.

In relation to child safety, some of the specific design features of developments which need particular attention in family projects include opening windows, stair and balcony railings, stair configuration and proportions, play area enclosures and railings, the locations of heaters and electrical outlets, and the choice of non-toxic landscape materials[89].

Conclusion

An understanding of the social, physical, and environmental infrastructure needed to ensure children's wellbeing and healthy development is essential, and must be central in planning by all levels of government and developers. Neighbourhood design and the built environment can have a direct impact on healthy child development, and can also influence other key factors such as social cohesion and support, either as a facilitator, barrier, or modifier of behaviour.

The City is undoubtedly aware of the importance of using best available evidence and research to understand community needs and to work with developers to meet these needs, for example by ensuring parks are designed for different developmental ages, community infrastructure is sustainable and delivered with community, and destinations are desirable and walkable. Challenges include an already overloaded road system; reliance on State Government for elements such as public transport infrastructure and schools; and limitations on the availability of green open space and other resources.

It will be important to address these challenges and ensure that the Green Square development is indeed a Child Friendly City as advocated by UNICEF. In particular, the rights of children to "walk safely in the streets on their own, meet friends and play, have green spaces for plants and animals, live in an unpolluted environment, and participate in cultural and social events", will need to be strongly protected in the context of the Green Square development[15].

Family and child-centred research into the needs of children growing up in specific high-density environments in Melbourne has pointed to actions that can be taken at City level to support healthy child development. The recommendations include, among others, that: the City [of Melbourne, in this case] should include a requirement of 5% public park space for all new residential, commercial, and office development within the planning area, along with identification of locations for these parks and a schedule for their delivery; locations and a schedule for larger play spaces should also be noted in planning; the City should work with businesses to promote workplace childcare centres within the planning area for use of both workers and residents; the City should require a multi-purpose room in every new residential development for use as a community meeting room or a neighbourhood house; the City and the state government should begin construction on at least one 'heart' or community hub, consisting of a local primary school, adjacent childcare and out of school hours care facilities, a park that could be used as a playground for the school and childcare as well as an after-school hours playground; and a 30kph limit for all streets that are being promoted as walking or cycling arteries, consistent with international best practice on promoting active travel. Recommendations also covered the need for high schools, shops, and continuous pedestrian space[69, 90]. The City of Sydney could consider the relevance of these recommendations for the Green Square development.

Research by City Futures Research Centre, UNSW has identified specific aspects of urban child-friendly environments to support healthy behaviours. The report concluded that:

- Well-designed streets and neighbourhoods can create supportive environments for children to be physically active and socially connected as part of everyday life.
- Creating such environments involves traffic management as well as developing elements that appeal to children exploring their local area.
- It is important for children to be able to walk or cycle to school along routes that are safe, fun for exploring and learning, and clearly sign-posted.
- Accessible play spaces and parks promote physical activity and social interaction.

- Access to green, wild spaces is critical for physical and mental health, while indoor lives and constant supervision contribute to both physical and mental health problems for children including obesity, attention deficit disorder and depression.

The findings of this report strongly align with these conclusions, and additionally point to the importance of planning controls that ensure ready access to key local destinations including high quality local schools, and building controls that ensure that high-density living is family-friendly.

Attention to these issues will help to mitigate potential risks to healthy child development arising from the Green Square development.

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Appendix 5. Social and Community Infrastructure Assessment Report

The significance of social and community infrastructure

This assessment report examines available evidence relating to the impact of social and community infrastructure on the health of urban populations. It aims to inform planning for the City of Sydney Green Square development.

Social infrastructure has been described as "the interdependent mix of facilities, places, spaces, programs, projects, services and networks that maintain and improve the standard of living and quality of life in a community." Social infrastructure is seen as important in encouraging social inclusion, supporting diverse communities, creating sustainable communities, improving health and wellbeing, providing access to facilities, services and programs, supporting a growing population, and assisting economic development"[86p1].

While social infrastructure is often categorised as either "hard infrastructure" (such as health facilities and centres, education facilities, recreation grounds , police stations, fire and emergency service buildings, art and cultural facilities and other community facilities, or "soft infrastructure" (such as programs, resources, services, and community and cultural development)[1] for the purposes of this report we use the four categories of social and community infrastructure that are set out in the City of Sydney's vision for Green Square[2]:

1. Hard infrastructure, such as streets, cycleways, pedestrian routes, public transport, open spaces, drainage, energy, water, and housing.
2. Social infrastructure, such as community facilities, libraries, schools, health care, leisure facilities, wayfinding, and emergency services.
3. Community connectedness, cohesion and safety, including sense of identity, sense of connection to place and community, connection to heritage, history and culture, and public art.
4. Vibrant local economy, including retail mix, night time economy, business/economic diversity, and learning.

This report focuses on the first three components listed above (hard infrastructure, social infrastructure, and community connectedness), and on their health impacts.

Green Square is the largest urban renewal project in Australia, and one of the fastest growing areas in Sydney. The City of Sydney's Community Strategic Plan recognises that urban renewal sites, such as Green Square, provide the opportunity to greatly improve the social, economic and environmental performance of the City and Sydney region. The City of Sydney has a high level vision for Green Square: it will be a vibrant sustainable village in which to live and work, incorporating retail, food, entertainment, and a public domain that supports cultural and community activities including public art. The City recognises that in order to achieve this goal, local communities need to have the facilities, resources, capacity, confidence and resilience to adapt to changing circumstances[3].

Creating liveable and healthy communities within former industrial or 'infill' sites offers unique opportunities for developers and councils to imagine and create new communities including through the provision of a high level of amenity and facilities. These developments, however, face the challenge of providing a sense of community through built form and service provision in higher density environments, which were not traditionally required or expected in lower density suburbs of the past. The extent to which a sense of community exists within residential developments has thus become a significant contributor to improving the quality of life[4], health and standard of living, particularly within 'infill' developments where little infrastructure existed.

It has been commented that the most challenging assignment for developers on the urban fringe is creating a sense of 'community' or 'place' which means the community having ready access to the range of social and physical infrastructure one would normally associate with an established community[5]. Increased urban density clearly brings advantages for some residents including proximity and walkability to work, access to public and private amenities, community diversity and a liveable, urban lifestyle. However, not all community members may benefit. Challenges for rapidly growing, high density urban populations can include, for example, housing affordability, social isolation, limited access to social services, and transport congestion.

Traditional measures of urban development focused on economic indicators of growth. However, it is now recognised that urban performance depends not only on the city's endowment of hard infrastructure (or physical capital) and an educated workforce but also, and increasingly so, on the

availability and quality of knowledge communication and social infrastructure (human and social capital) to support community cohesion and wellbeing.

This report outlines the policy context for urban social infrastructure development in Section 2, before discussing in Section 3 the literature on the relationship between urban environments and health, and on the health impacts of hard infrastructure, social infrastructure, and community connectedness. Key findings from the literature review are summarised in Section 4; and the implications for the Green Square development are discussed in detail in Section 5.

Policy context

National policy context

Infrastructure Australia's document *Our Cities, Our Future: A National Urban Policy for a Productive, Sustainable, and Liveable Future, 2011* represents the overarching national strategic framework for urban development in Australia[6]. The policy's key themes are productivity, sustainability, and liveability, and under the latter theme, issues relating to hard infrastructure, social infrastructure, and community connectedness are discussed. In particular, Strategy 11 of the policy focuses on supporting community wellbeing by: providing access to social and economic opportunity; improving the quality of the public domain; improving public health outcomes through built environments that are designed to enable people to travel safely by walking, cycling or using public transport, and that provide access to quality open space; redressing spatially concentrated social disadvantage; and enhancing access to cultural, sporting, and recreational activity[6].

State of New South Wales policy context

In 2012 Infrastructure NSW released a 20-year *State Infrastructure Strategy*. Two years later Infrastructure NSW released its *State Infrastructure Strategy Update 2014*, which sets out 30 recommendations to Government on the next round of infrastructure investment in NSW [7]. The report and its recommendations focus on large hard infrastructure projects, some of which including the Sydney Rapid Transit program and the WestConnex extensions have implications for public and private transport in the Green Square Urban Renewal Area[7]. Recommendations for investment in health services, educational facilities, and cultural and sporting facilities are also relevant. There is limited focus on other aspects of social and community infrastructure beyond a recognition that a priority for Sydney's long-term infrastructure planning should be to improve the liveability of the city and ensure the visitor economy is supported with timely and economic investments in cultural, sporting and recreational infrastructure[7].

The NSW Government has indicated its appreciation of the relationship between built environments and health, acknowledging the strong evidence demonstrating the links between chronic disease and lifestyles characterised by car-dominated transport, reduced opportunities for exercise, increased fast food availability and lack of social connection; and developing strategies to address physical activity opportunities, healthy food access, and opportunities for social and community interactions [4] Key policy documents developed by the NSW Government which are relevant to these issues include the *Healthy Urban Development Checklist* [8] and the *NSW Healthy Eating and Active Living Strategy 2013-2018*[9] Active living was also promoted by the Premier's Council for Active Living, but this initiative was discontinued in 2016[10].

The NSW Government in December 2014 published *A Plan for Growing Sydney,* a new overarching strategic plan for Sydney for the next 20 years[11]. The strategy prioritises intensive development of several strategic locations within Sydney, including Green Square, with growth in these locations seen as critical to sustaining and expanding the economy and supporting more jobs closer to where people live[11].

City of Sydney policy context

At local level, the City's *Sustainable Sydney 2030: The Vision* sees the southern part of the city including Green Square as an opportunity for considerable growth, infrastructure improvements, and redevelopment to contribute significantly to Sydney's sustainability[12]. The City of Sydney's *Creative City, Cultural Policy and Action Plan 2014-2024* guides the City's cultural development and facilities planning over that ten-year period [13] . The six priority areas of the Plan are: precinct distinctiveness and creativity in the public domain; new avenues for creative participation; sector sustainability; improving access, creating markets; sharing knowledge; and global engagement[13]. In March 2015 the City released the *Green Square Draft Infrastructure Strategy and Plan*, which sets out in detail the history of the site, the current status of development, and plans for the future[2]. The plan includes significant consideration of social infrastructure (Section 7 of the plan), with reference to research into future social infrastructure needs against benchmarks, commissioned by the City and undertaken by SGS Consulting (Appendix 2 to the plan). The Plan acknowledges the importance of a range of social infrastructure and services in supporting community connectedness and the development of social capital, and lists the following key risks for Green Square:

- Provision of community facilities and services may not keep pace with population growth.
- Some services, such as education and health provision are not the responsibility of the City.
- Differing cultural backgrounds, beliefs and traditions can potentially lead to cultural isolation.
- Placemaking strategies and programmes may not respond to community needs.

The Plan and its implications are discussed at the end of this report.

Potential health impacts of social infrastructure

The population of interest

The Green Square and City South Village estimated resident population in 2011 was 20,013 people, and this is projected to grow to at least 54,170 by 2030[14] – note that latest figures on the City of Sydney Green Square website now put this estimate at 61,000[15].

Demographic data indicate a culturally diverse population, with 53.4% of Green Square and City South Village residents born overseas, and 41.8% coming from countries where English is not the first language. The three top ranking countries of birth were Australia, Other Asia, and China (including Hong Kong). At home, 45.7% of residents speak a non-English language either exclusively, or in addition to English – far higher than the average of 34.4% for the City of Sydney overall[14].

A community survey of Green Square residents was commissioned by the City of Sydney in 2014 in an effort to measure the nature of social cohesion and social interaction and identify opportunities and barriers residents face in contributing to social cohesion and community development; and to understand the wellbeing of residents and workers, including their satisfaction with and attachment to the area, their local area preferences and desires, and their plans for the future[3]. The key findings of this survey are reported in detail at Section 5 of this paper. In summary, the researchers concluded that the findings of the survey paint a picture of community with a high proportion of time-poor people who desire more social interaction with others who live and work in the area, but who have difficulty finding out what opportunities are available to them to socialise with other people in their area. Only a small proportion have become actively engaged in trying to improve their community and an even smaller proportion feel that their thoughts about the community would be taken into account by local leaders or others who could make a difference. The survey also highlighted the existence of smaller, yet significant, pockets of the population whose social interactions and participation are constrained by lower incomes, feelings of exclusion, and access and language barriers.

The literature in relation to the relationship between urban environments and health, and the health impacts of social and community infrastructure will now be explored. The literature review focuses on hard infrastructure, social infrastructure, and community connectedness. The literature review does not cover matters relating to the local economy, as these are considered out of scope for the

purposes of this report. Affordable housing as an element of social infrastructure is also not discussed here, as it is covered in detail in a separate report on housing affordability for this Health Impact Assessment.

Following the literature review and a summary of its findings, the health implications of social and community infrastructure for the Green Square development will be discussed.

The relationship between urban environments and health

Infrastructure Australia has noted that the planning and design of local neighbourhoods and urban centres affect a community's wellbeing and is a major factor in determining quality of life of our population[6]. Contributing factors to the amenity of a neighbourhood are identified as including access to green and open space, water and air quality, pleasant streetscapes, and opportunities for recreation and social interaction. Factors that detract from the amenity of places include noise, pollution, traffic, and degraded built and natural environments. Low quality environments have been correlated with poor public health outcomes such as increased mental health issues and higher rates of obesity, diabetes and respiratory illnesses, resulting in high social and economic costs. It is also noted that preventative health campaigns by all levels of government are consistently aimed at encouraging activity and time spent outdoors. However, many urban and suburban environments are car dominated, and so are not conducive to either incidental exercise (for example walking for local errands or to public transport) or recreational exercise[6].

Australian research on high density urban living indicates that desirable attributes of urban locations identified by residents include:

- Proximity to the city and desirable locations (beaches, entertainment).
- Local character and heritage.
- Good public transport – train services are particularly highly valued, however a perceived lack of connectivity of public transport services is undesirable.
- Open spaces, trees and green areas.
- Access to quality education to raise children.
- Easy access, including walkability to a wide range of services and social infrastructure.
- Affordable housing.
- Cultural and demographic diversity

A growing body of literature has emphasized the importance of "place" to people's health, with a frequently cited finding suggesting that a person's postcode can be a larger determinant of a person's health than any other factor, including genetics. Numerous studies have shown that differences in how low and high-income neighbourhoods are designed and function contribute to health disparities. For example, the University of Wisconsin Population Health Institute found that just 10 to 20 percent of a person's health is related to access to care and the quality of services received. In comparison, over 40 percent of the contribution to the length and quality of a person's life comes from social and economic factors, while another 30 percent is derived from health-related behaviours directly shaped by socio-economic factors, and an additional 10 percent is related to the physical environment[16].

Research shows that low-income groups and minority groups have limited access to well-maintained parks or safe recreational facilities, and that low-income urban neighbourhoods are more likely to lack features that support walking, such as clean and well-maintained sidewalks, trees, and attractive scenery[17] [18]. For example Canterbury Local Government Area has far less public green space than Leichhardt Council despite it being further from the CBD. Low-income areas are also significantly more likely to lack access to supermarkets and places to obtain healthy, fresh food than wealthier areas[19].

Hard infrastructure

As defined by the City of Sydney, hard infrastructure includes elements such as streets, cycleways, pedestrian routes, public transport, open spaces, drainage, energy, water, and housing. Hard infrastructure gives form to the community and provides opportunities to access employment, education, recreation, open space and food. It is a building block for communities.

The NSW Healthy Urban Development Checklist identifies a number of key considerations for infill development sites including: open space; food supply; housing choice and affordability; adaptable housing; access to public transport; and schools[8].

In the past, services and facility provision has often been timed ineffectively with housing development, to create service deficiencies when residents first populate a given development. State government and developers have the greatest influence on several aspects of hard infrastructure including public transport, roads, housing quality and affordability, and provision of schools and health services. Local government plays a key role in the provision of community services and facilities; creating partnerships; advocacy; management and maintenance of social infrastructure; and as an information provider. Councils can fund infrastructure through levy

developer contributions, as a condition of development consent, towards the cost of providing local public infrastructure and facilities required as a consequence of development via the Environmental Planning and Assessment Act 1979, Section 94. However, as with education and health infrastructure, community amenities are not usually provided until adequate finances are available for their construction and often after development has been completed.

From a health perspective there is consistent and growing evidence that the way communities are planned can have a direct impact on health, for example by influencing levels of physical activity, access to healthy food, and mental health[20].

The health impacts of urban transport systems are explored in detail in another report undertaken as part of this health impact assessment. That report concludes that based on the evidence, to achieve positive health impacts, urban planning and the urban transport system must encourage uptake of active transport (primarily walking and cycling) and public transport, and discourage private vehicle use. Built environments and effective transport systems which promote higher levels of active and public transport and provide connectivity contribute to a healthy community by: improving people's health through greater physical activity; improving road safety and reducing road accidents; reducing the health impacts of traffic congestion and related air pollution; improving the sense of community safety as more people are visible on streets and paths; and reducing residents' costs of living if they do not need to own and run private vehicles, freeing up household resources and promoting wellbeing.

Infrastructure Australia has noted that built environments that are designed to enable people to travel safely by walking, cycling or using public transport, and that provide access to quality open space can help to maintain mental health and increase levels of physical activity and social interaction, with positive health benefits[6]. A number of preventative and public health objectives can be achieved through better designed built environments and transport networks that encourage active travel, recreational and incidental exercise, social interaction and enjoyment of the natural environment[6].

Research illustrates how consideration of social infrastructure and amenities can support wellbeing, health and sustainability agendas. Quality of social infrastructure can have a direct effect on residents', in particular, children's happiness, health, development and life-chances. Important considerations include whether children are allowed or able to play safely outside, whether they can walk safely to school, and whether there is space for activities such as cycling. Research in the

United Kingdom (UK) identified how planners can have long-term positive effects on public health, for example through supporting eco-friendly infrastructure and sustainable transport networks[21].

Several aspects of the built environment in high density urban areas can impact on the mental health of residents[22]. A review of studies linking urban environments characterised by physical and social 'incivilities' with poor mental health found that living in an environment with derelict buildings, litter, excessive traffic and general over-crowding has a cumulative and lasting impact on mental health status[23].

An element of the built environment associated with social interaction, feelings of connection and stress, is the extent to which the built environment is cared for and maintained. A lack of upkeep and maintenance can act as a physical indicator to underlying social disorder or fragmentation. The 'Broken Windows' theory[24] holds that the built environment plays host to signals of societal breakdown, such as derelict buildings, graffiti, vandalism, rubbish, conflict, public drinking, drug use and other forms of evident criminality. Further, this breakdown negatively impacts connection to place [25]. The Broken Windows theory has been repeatedly supported by research. For example, a Perth study exploring the relationship between social capital and aspects of the built environment, based on data collected from 335 residents of three suburbs in metropolitan Perth, concluded that a high level of neighbourhood upkeep was associated with greater social capital and feelings of safety[26].

In New York, signs of deterioration of the built environment have been found to be significantly associated with an increased likelihood of fatal accidental drug overdose. The authors propose that disinvestment in social resources may be one element explaining the increased risk of harm[27].

A large review of European housing and health status for the World Health Organisation (WHO), [28] found significant relationships between noise exposure and depression.
The physical appearance of a neighbourhood can affect resident's perceptions of liveability. A detailed study of the development of new high density residential neighbourhoods in the City of Vancouver[29] found that lining the ground floor of high rise apartment buildings with townhouses that have street entries can contribute a sense of liveability, providing life and visual interest on the street. Although the ground floor 'townhouse' type dwellings constituted just two percent of total dwellings constructed in the neighbourhoods, they dominated the 'feel' of each neighbourhood. This was because they constituted much of what was immediately seen from the street.

Providing welcoming and safe common areas around apartment blocks or facilities for comfortable waiting at public transport stops, for example, can encourage the incidental interactions which become building blocks of community.

Community development strategies that improve neighbourhood amenities and opportunities, including creating walking trails and bike paths to facilitate exercise and attracting retail establishments, including grocery stores and farmers' markets, can contribute to increased physical activity and healthier eating[30, 31]. Areas near current or planned public transit stations represent a particularly favourable opportunity to integrate these features as demand for transit-oriented development rises. New or redeveloping communities in these areas can be designed to provide access to an array of retail outlets, schools, and other services within walking distance, which may reduce residents' reliance on personal vehicles and promote the many health benefits associated with walking, including lower cholesterol and blood pressure levels, improved mental health, strengthened social ties, and reduced risk of obesity, cardiovascular events, and type 2 diabetes [32, 33].

Research suggests that streets designed for walking and cycling will also promote social interaction. Richard et al[34], for example, found regular walking to be a strong predictor of social participation by the elderly living in Montreal, Canada[34]. Commercial streets are popular as social spaces for strolling and meeting, rather than simply channels of movement. Seating provided by businesses and public authorities, places to meet in the foyer of buildings, along with street furniture in town centres, were found to be particularly important in creating social and convivial streets. Businesses that serve as community places, for example privately owned squares and malls accessible to the public, were also important, as was the presence of wide footpaths. Personalised street fronts were also noted as contributing to social activities on neighbourhood commercial streets[20].

Infrastructure Australia has noted that the public domain can provide environmental amenities such as shade and greenery, aesthetically pleasing buildings and infrastructure, quality public art, and a sense of safety and security; and provides much of the character and amenity of a place. It is noted that local government is responsible for planning and managing much of the public domain; but decisions of all levels of government, as well as individuals, have an impact. Continued investment in the public domain can help ensure cities and neighbourhoods are enjoyable, encourage social interaction, and provide opportunities for a variety of activity and exercise[6].

Planning for public spaces is important in facilitating day to day interactions. Research on informal public and common spaces outside three high-density residential communities in Brisbane by Zhang and Lawson[35] found that such spaces should be useful and have a welcoming design. This can be as simple as promoting common entries and inviting stairwells. Car free areas and laneways allow more pedestrian-oriented and sociable streets and can act as places for casual social interaction. In a survey of four San Diego neighbourhoods with alleys, Ford,[36] found residents used these spaces for many purposes, including informal socialising with neighbours. Hess,[37] found that alleys in new urban developments create a secondary shared space that both supports causal interaction yet competes with space in the formal street. However more compact, higher density areas displayed particularly low scores for social interaction, faith-based social capital, and giving and volunteering[38].

Literature discussing the role of the built environment in developing communities and promoting social interaction often highlights the contextual nature of interactions in neighbourhoods, which may vary according to time of day[39], seasons[37], community homogeneity, age, sense of safety and stability[40]. Place does not, by itself, guarantee a remedy to strengthen a weak community. For example public places are increasingly privately owned – an arrangement where regulatory concessions can be granted to developers to provide spaces such as town squares, pedestrian malls or pocket parks[41]. Rules and regulations, as well as design, can be used to both intentionally and unintentionally exclude some users. For example, teenagers will require different places for opportunistic interaction and often be less welcome than the elderly[42].

Urban design and hard infrastructure can also play a role in promoting community safety. Perceptions of crime and actual levels of crime within communities both have powerful direct and indirect impacts on health through injury, stress, damage to property, vandalism, and theft. There are also more indirect impacts such as reluctance to use open space, not feeling safe to exercise or walk in the area and reputational damage that effects, the desirability of the area, perceived quality of school and other local services. Feeling unsafe in itself impacts mental health. Many of the environmental conditions that impact on safety are thought to be amenable to urban planning and design. The NSW CPTED (Community Safety through Environmental Design) has been demonstrated to a reduction in the fear and incidence of crime, and improvements in the quality of life[43]. CPTED type interventions have been shown to reduce depression, improve coping and mental health well-being of community members[44].

Urban design and planning can promote community engagement, as simple elements like bus

stops, benches and local gardens can encourage incidental interactions which help to build community cohesion. The strategic provision of green spaces beyond their traditional role as recreational areas has also been identified as a key resource in areas of high urban population growth, enabling increased physical activity, social connectivity and improved mental wellbeing[45].

Green spaces have a positive effect on health, clean up the air, buffer noise pollution, help stabilise the temperature and add to people's wellbeing. Open spaces and nature facilitate physical activity and contact with community. A comprehensive review of the relationship between nature and health suggests mere visual contact with nature (that is, without actually being physically active or immersed in nature) has health benefits and an environment devoid of nature has a negative effect on health and quality of life[46]. The health benefits of contact with nature include attention restoration, stress reduction, and social engagement and participation[47].

Extensive research supports the relationship between access to green open spaces, and mental health and wellbeing. A survey of 1,895 residents of Adelaide explored relationships between mental and physical health and perceived greenness in the environment. It found a significant relationship between greenness and mental health, and found that recreational walking and social cohesion only accounted for part of this association[48]. Contact with nature is particularly important in highly urbanised environments, and research indicates that small scale encounters with nature and people within natural settings are equally significant to health as access to large areas of natural open space[49]. A Los Angeles Family and Neighbourhood Study (LAFANS) and found that parks were independently and positively associated with collective efficacy, that is a place for neighbourhood social interactions, thus serving as a foundation for underlying health and well-being[50]. A study of an elderly cohort of UK residents found that parks were integral to interaction and mental health[51].

Conversely, research suggests that 'building out' natural elements (including plants, animals and even the weather) is fundamentally detrimental to health. In the Netherlands, lack of green space in people's living environment was associated with feelings of loneliness and a perceived shortage of social support[52].

Research indicates that the vast majority of people (91%) believe that public parks and open spaces improve quality of life. Conversely, research indicates that people who live on high traffic streets have a poorer quality of life; and residents on the quietest streets have more local social connections and are more likely to garden, sit outside and let their children play on the street and go to school unaccompanied [21].

Green spaces can provide respite from noise pollution. A survey of 500 people living in both noise affected and noise unaffected high density developments in Sweden found easy access to nearby green areas can offer relief from long term noise annoyances and reduce the prevalence of stress related psychological symptoms. A similar study of adults in higher density areas in London, UK found that the perceived ability to escape to green spaces away from noise and over-crowding was significantly linked to mental well-being[53]. Green open spaces also offer an opportunity to better accommodate companion animals – a consistently cited catalyst to social capital and mental and physical health[54].

Social infrastructure

As defined by the City of Sydney, social infrastructure encompasses elements such as community facilities, libraries, schools, health care, leisure facilities, wayfinding, and emergency services. Social infrastructure and services play a critical role in supporting community connectedness and the development of social capital, particularly where a community is rapidly growing and changing, and the social impacts of the urban renewal process and associated population growth need to be effectively addressed[2].

Extensive research in the UK has confirmed that new communities need services and support, not just buildings. Social infrastructure and services have been found to be as important as good quality housing and need to be in place early in the life of a new community. Some of the strongest evidence about the importance of social infrastructure and amenities comes from the experience of residents arriving in the English New Towns: 32 new communities created between 1946 and 1970 to provide homes and job opportunities for residents. Central to the New Towns concept was the idea of “walking distance communities” where each neighbourhood would contain a school, shops, post office, chemist, church, pub, community centre and sports facilities. A review of the New Towns experience concluded that "where these facilities were already in place when people began to arrive, the community came together and networks were formed more easily[21].

As lessons from the New Towns review identify, new residents need local social networks and shared community experiences to build a sense of belonging and identity in new places. Evidence identifies that inadequate social infrastructure is not just an inconvenience for residents but has significant long-term consequences, and associated costs, for new communities. The New Towns review describes how "a spiral of decline" can occur when there are problems with the quality of the physical environment, poor local services and weak social networks in the community. There is little

to prevent the families that can from relocating, leaving behind residents who have no choice but to stay in an area[21].

The New Towns research indicates that schools play a particularly important role in encouraging the kind of informal social contact that is needed in new communities. In cases where it was not possible to provide sufficient local schools and teachers, this was found to hinder the integration of communities. Schools can also provide a hub for community services or community groups, either in the short-term while other facilities are being developed, or long-term. Early provision of good quality schools and child care was found to be important in encouraging more affluent families to use local facilities and not seek out school places in neighbouring areas, which can create long-term issues with the reputation of local schools. Lessons from the New Towns review stress the importance of building school facilities before new residents arrive, and also providing affordable key worker housing for teachers to live in[21].

The infrastructure needed to serve a community depends on the size and characteristics of that community, including age, resources and cultural need. Core community infrastructure may include: children's and family services facilities across the life cycle (e.g. preschool services, child care, youth services, aged services); indoor and outdoor sport and recreation facilities; libraries; arts and creative spaces; passive and active open space; general population facilities such as neighbourhood houses and meeting spaces (cultural buildings, recreation buildings, halls or spaces incorporated into multipurpose settings); and facilities for people with special needs (e.g. disability, rehabilitation, inclusive places for specific groups such as Aboriginal, same sex attracted, and gender diverse people [55]. This infrastructure can accommodate community support services, programs and activities community meetings, sporting competition, informal recreation, cultural activities, health programs, education activities, emergency services, community support, and so on.

There are few examples in Australia where the community, cultural or social values of facilities have been clearly defined in policy and operational statements. Other than community facilities and public buildings that meet the community development, recreational, social and cultural needs of individuals and neighbourhoods it has been suggested that community infrastructure is less well understood and recognised by the general public and, at times, policy makers. The problems have been that 'soft' infrastructure is seen as intangible or hard to define; difficult to measure and cannot always be reduced to quantitative indicators; and often described in subjective and qualitative terms that may not be readily understood[56] .

The limited understanding of ‘soft’ infrastructure is evident in performance measures applied to community infrastructure. An initiative of several metropolitan Sydney councils to develop facility performance measures succeeded in the area of financial and environmental performance, but foundered when it came to social value[57]. Common measures such as facility use and client satisfaction ratings tend to dominate evaluations of community infrastructure. There has been no systematic attempt to map cultural or social assets.

Infrastructure Australia has, however, noted that improving access to cultural, sporting, and recreational activity can contribute to better community health and has a range of other benefits. For example, the benefits of sport have been shown to include: enhanced academic outcomes; increased self-esteem and social confidence; development of life skills such as team work, fair play and strategic thinking; community building and social cohesion; social inclusion of minority and disadvantaged groups; and enhanced mental and physical well-being[6].

New communities can take many years to complete, and in the meantime residents can find themselves surrounded by semi-dereliction and building sites during their first few years of settlement. Intermediate or ‘meanwhile' use of land and buildings can provide much-needed space for community activities and interaction. There is growing interest in the idea of ‘meanwhile uses' and spaces, from allotments in empty plots of land to empty buildings temporarily housing social enterprises, community projects or drop-in clinics for local public services[58].

Community connectedness

As defined by the City of Sydney, community connectedness encompasses elements such as a sense of cohesion and safety, a sense of identity, a sense of connection to place and community, and connection to heritage, history and culture, and public art.

There are strong links between the built environment and community connectedness. Research into the relationship between the built environment and social inclusion suggests that the way streets, houses and public spaces are designed can have a profound effect on how people perceive and experience inclusion or exclusion in their community. The research indicates that walkable streets, mixed use neighbourhoods, accessible public spaces and the provision of quality, affordable housing all work together to provide opportunities for enhanced community connectedness and help to build strong, resilient communities[45].

The concept of social sustainability allows for the consideration of the importance of social interaction and cohesion for the sustainability of communities. Barron et al,[59] define social sustainability as occurring when: “the formal and informal processes, systems, structures and relationships actively support the capacity of current and future generations to create healthy and liveable communities. Socially sustainable communities are equitable, diverse, connected and democratic and provide a good quality of life”.

A major US Social Capital Community Benchmark Survey has found that social connectedness is a much stronger predictor of the perceived quality of life in a community than the community's income or educational level. Similarly, personal happiness has been found to be much more closely tied to the level of community social connectedness and trust than to income or educational levels. People’s personal happiness is not directly affected by the affluence of their communities, but it is quite directly affected by the social connectedness of their communities[60].

It is not surprising, then, that social cohesion in neighbourhoods has been shown to be strongly correlated with mental well-being [61]. Adults who live in neighbourhoods that they perceive to have strong cohesion are buffered from daily stresses and report better physical health[62]. Conversely, communities with perceived social disorder have been correlated with higher rates of anxiety and depression among residents[63].

Studies show that the social cohesion of a community is largely dependent on the quality of a neighbourhood, which can promote social interactions through public spaces and facilities[48]. A number of related social problems are associated with new communities that lack good social infrastructure, including isolation, mental health problems, fear of crime, and issues with community cohesion. The term "new town blues" was coined to describe the isolation that many people in the UK New Towns, in particular young mothers, felt at being separated from friends and family and having few opportunities to meet other people living locally[64].
Research on social capital and wellbeing suggests that everyday interactions with friends, family and neighbours play a crucial role in sustaining a sense of community but can be extremely fragile. Community outreach workers have been found to be important to residents in new communities.

Community development, neighbourhood management, community time banking or volunteer neighbourhood champions have been identified as practical supports that can help build a sense of belonging in new communities, and arguably, prevent the feelings of isolation that contribute to the problem of "new town blues". Neighbourhood-based workers, whether they are volunteers or part of

a neighbourhood management team have an important role to play in new communities by creating spaces for people to interact with neighbours through local events, street parties, sports, arts and culture events, consultation and community planning work. These approaches are proven to be effective at engaging residents and helping to support strong social networks and working to breakdown barriers and reduce tensions between different social, faith or ethnic groups. This is particularly important where new communities or settlements are creating tensions with existing residents. Neighbourhood management has become widespread in the UK as an approach to champion local issues, improve local service delivery, engage residents in decision-making and work effectively in local, multi-agency partnerships[21].

Compact and mixed-use urban forms are arguably more socially sustainable because they typically improve access to services[65], reduce levels of social segregation and inequity [66] increase vitality and social interaction[67] and improve safety due to higher levels of passive surveillance [68]. However, many of these supposed social benefits of higher density and mixed-use living remain unproven in the literature[36].

Social sustainability is a major strategic component of the European Union's (EU) Smart Cities strategy and some lessons may be learnt. This strategy aims to achieve urban growth in a 'smart' way, based on evidence for healthy, effective communities [69]. This is defined as follows: "A city is smart when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance" [69].

Some European cities have managed to attract a more highly educated and skilled population to new urban developments, and to create communities that are more socially connected and successful. An audit by the EU of 250 comparable statistics and indicators for European cities found a correlation between employment in the culture and entertainment industry and GDP per head, suggesting that it is the mix of the creative class and human capital in sustainable urban development that determine the very notion of a 'smart' city. The EU research found, however, that when social and relational issues are not properly taken into account, social and cultural polarization may arise as a result. Poelhekke,[70] found that a concentration of high skilled workers is nevertheless conducive to positive urban growth, irrespective of the polarization effects that this process may generate.

In considering social cohesion, it is important to consider both social interaction and sense of community. The term social interaction is an all-inclusive term that is used to describe a wide range of human interactions including those that are brief, longitudinal, and cooperative and life threatening[67]. Research investigating the impact of having poor vs. adequate social relationships has demonstrated that the health benefits of enjoying adequate social relationships are comparable to the effect of quitting smoking. Psychological sense of community refers to the affective components of neighbourhood social life including shared emotional connections, neighbourhood or place attachment, membership, influence, reinforcement and sense of place[67]. Research has demonstrated how having an emotional connection to a place increases individuals motivation to improve their community[71].

No ideal density for a healthy built environment has been identified. Rather, it is the effects of distance and access mediated by densities which impact upon the built environment's ability to affect health[72]. Similarly, there is not a simple relationship between housing density and levels of social interaction. While a larger physical distance between dwellings can reduce the likelihood of social ties forming[72] some research[73] has found that scores of 'social sustainability' can be lower in high density places. Many factors other than density, such as safety, inclusion, mental health and population mix can also influence levels of social interaction. Overall, the research suggests that there is a threshold to be found between high and low densities for the formation of social networks and social interaction generally. People need to retreat to their private space but they also require opportunities for unplanned interactions.

There is no set formula for 'community' – it relates to demographic, cultural, ability, socioeconomic and other attributes. Community is complicated and varied, and what works to promote community in one locality, within a particular group or at one time, will not necessarily translate to another[20].

A sense of community and belonging within the places where people live, work and travel, influences mental and physical health[50, 74-76]. Positive social interactions and social cohesion are central to the success of large-scale residential redevelopments[77]. Belonging is universal and fosters perceptions of security, confidence and comfort which can encourage people to be 'out and about', physically active in their neighbourhood, as well as socially connected to others [78] Being 'out and about' also opens up opportunities for incidental interactions, which augments connection and caring, increases perceptions of safety and decreases feelings of loneliness and isolation, all of which have proven links to positive mental health[52, 79-83].

Safety is a key concern for residents moving into new communities. Creating places that feel safe is complex as perceptions of danger are often greater than the actual threat posed. The design of the built environment has an important role to play in creating the infrastructure that can prevent criminal behaviour; and also in creating a sense of safety within communities. Intimidating environments which appear neglected and underused can typically cause people to feel unsafe, in contrast to well-designed active spaces which promote feelings of safety. Research indicates that "once a development has been completed the main opportunity to incorporate crime prevention measures will have been lost" [84].

In addition, there are significant cost implications for maintaining safety in places that have been badly-designed. For this reason, it is essential to consider these design issues at the planning stage. It has also been found that once a neighbourhood has a reputation for being unsafe, it is difficult for a community to change those perceptions. Many urban theorists and sociologists have argued that safe communities are essentially self-policing: if there is a sufficient level of permeability encouraging street activity, neighbourliness and public surveillance then communities will naturally look after themselves[21].

Increased density, growth in the number of sole households and limited social connections among residents can result in isolation and loneliness within communities. The health impacts are substantial and include mental health problems, sleep deprivation, anxiety and depression[85].

Indeed, loneliness has been identified as one of the most potentially corrosive effects of social exclusion in urban areas. Loneliness is linked to a number of poor physical and mental health conditions. People living alone are more vulnerable, both socially and economically, in the face of adversity, than those living with others, and this vulnerability is exacerbated by poor mobility options and poor accessibility to amenities, which can be negative attributes of built environments. Studies have shown that 'neighbourliness' of a community is a key factor in tackling loneliness. 'Neighbourliness' can be supported and encouraged through the creation of opportunities for social interaction and the creation of safe communities. Important attributes identified in the creation of a 'caring community' include suitable housing, accessible public spaces and facilities and meeting over shared concern (through initiatives such as allotments for example). Walkability is also important in encouraging incidental and casual meetings which can compact loneliness and isolation. The promotion of walkability and the provision of accessible public space supports a built environment as the basis for an active, convivial and engaged society and a "platform upon which an increasingly inclusive community can live, work and play"[45].

The co-creation of space has also been found to be crucial in enabling proactive responses to social isolation. Planning and negotiation that facilitates interaction and sharing between people is a key tool in the promotion of social inclusion in communities. Research suggests that "participation in shaping the built environment supports interaction and psychological health directly by encouraging a sense of empowerment and custodianship"[45].

"Placemaking" is both an overarching idea and a hands-on approach for improving a neighborhood, city, or region. The approach is intended to inspire people to collectively reimagine and reinvent public spaces as the heart of their community, strengthening the connection between people and the places they share, and maximising shared value. More than just promoting better urban design, Placemaking aims to facilitate creative patterns of use, paying particular attention to the physical, cultural, and social identities that define a place and support its ongoing evolution. Placemaking is both a process and a philosophy. It is centred around observing, listening to, and asking questions of the people who live, work, and play in a particular space in order to understand their needs and aspirations for that space and for their community as a whole, and to create a common vision for that place which can evolve quickly into an implementation strategy [86]. Placemaking offers a facilitative role in linking urban planners, designers and developers with community engagement specialists, artists and architects, to create quality places.

A review of literature on Placemaking has drawn the following conclusions [86]:

- Encouraging social interaction, community building, and civic engagement within a public space—all central components of placemaking—yields important physical and mental health benefits including a greater sense of belonging, increased physical activity, and reduced rates of depression and psychological distress. Research shows that the experiences of volunteering, acting in a leadership role, organizing and recruiting others, and learning new skills, all facilitate key social processes that benefit health. Other studies indicate that engaging community members in a public space's planning process increases the degree and frequency of its use.
- Because of health inequities tied to income, cultural group, gender, and geography, placemaking efforts can have the most substantial impacts on low-income and marginalised communities. People with poor English skills and single mothers are less able to participate in meaningful employment and study to improve their economic opportunities; people living below the poverty line are 25 percent more likely to develop hypertension. Research shows that low-income neighbourhoods are more likely to lack access to fresh and healthy food, and public spaces in these areas are also more likely

to be poorly maintained, unattractive, unsafe, and lacking in greenery, which reduces physical activity and use. Community-driven placemaking activities like farmers market programs, footpath repair efforts and bike paths can build social capital while helping residents mobilize health-promoting activities.

- The active use of a public space depends on its features, appearance, proximity, and accessibility. Parks and other spaces that encourage physical activity and frequent use help combat obesity and related chronic diseases such as diabetes and heart disease. Research suggests that the public space qualities most likely to encourage use and produce to positive health outcomes for users are: appealing aesthetics; amenities for different age groups; good maintenance and cleanliness; opportunities for social interaction; safety; lighting; natural features such as trees, water features, or bird life; and proximity to home and other destinations like shops and services.
- Aesthetics and the visual appeal of the public realm play an important role in encouraging people to walk or bicycle. Along with assets like safe street design, accessibility, and mixed-use development, recent research links street aesthetics— trees, green infrastructure, and street furniture—to increased rates of walking and bicycling. Conversely, studies link poor aesthetics, such as rundown and littered environments, to increased anxiety and poor mood among public space users.
- A wide array of natural landscapes and greening strategies in the public realm produce multiple mental and physical health benefits including reductions in depression, anxiety, stress, Attention Deficit Disorder, diabetes and other cardio-metabolic risks, as well as improvements in working memory and physical activity levels. Community gardens in particular have been found to encourage a large number of health promoting behaviours, including increased consumption of fruits and vegetables, physical activity, socialization, and civic engagement.

Planning regulations can also promote community cohesion as well as public health and safety. For example, alcohol related injuries and violence are associated with urban environments where there is a high density of alcohol outlets (bars, clubs and bottle shops) and late night trading. Studies have shown 60 per cent of people presenting with injuries to emergency wards had consumed alcohol bought at a store in the hours leading up to their injuries[87] and that Research shows that violence in homes increases by 26 per cent for every extra 10,000 liters of alcohol sold[88]. Restrictions on trading hours, and fewer outlets have been effective in reducing harms[89].

Summary of potential key health impacts of social and community infrastructure

Potential health impact	Nature of impact	Consequence and severity	Populations impacted
Hard infrastructure			
Urban transport system	Uptake of active transport (walking and cycling) and provision and uptake of adequate, well-connected public transport promotes good health. High rates of private vehicle use are detrimental to health.	Active transport promotes greater physical activity, reducing overweight and obesity and consequent chronic disease. Active and public transport promote social interaction, improving mental health. Health consequences of private vehicle transport include injury and illness arising from road accidents, air pollution, and reduced physical activity.	Households with inadequate access to walking and cycling infrastructure, and well-connected public transport; and where key destinations such as schools, shops and workplaces are note readily accessible by active and public transport.
Care and maintenance of the built environment and public infrastructure	Lack of upkeep and maintenance of built environment and public infrastructure impacts on social interaction, feelings of connection, feelings of safety, and levels of stress.	Environments with features such as derelict buildings and litter can have a cumulative and lasting negative impact on mental health status.	Individuals and families living in neighbourhoods where the built environment and public infrastructure are not well cared for and maintained.
Exposure to noise	Noise can arise from road traffic and other sources and can impact negatively on mental health.	Significant relationships have been demonstrated between noise exposure and depression.	Individuals and families exposed to noise pollution.
Healthy food outlets	Access to healthy food outlets such as farmers' markets can contribute to healthier eating, while a high concentration of fast food outlets can be detrimental.	Healthy eating is a major contributor to healthy weight. Overweight and obesity are increasing in the community and are a key risk for several chronic diseases.	Households with inadequate access to healthy food outlets.
Well planned public domain	Aesthetically pleasing buildings and infrastructure, shade	Access to a well planned public domain is positive	People lacking access to a well planned public domain.

	and greenery, public art etc can contribute to social interaction, physical activity, and feelings of safety.	for mental and physical health.	
Housing and street design	Common entries and common areas within and around dwellings promote social interaction.	Social interaction is positive for mental health.	Individuals and families living in buildings and neighbourhoods that are not designed to promote social interaction.
Urban design that promotes public safety, both actual and perceived	Perceived and actual crime and danger can impact on health through injury and stress, and by discouraging physical activity and social interaction.	Feeling unsafe in itself impacts on mental health, including depression.	Households in neighbourhoods that have high levels of crime or are not perceived to be safe.
Access to green open spaces	Green open spaces clean the air, buffer noise pollution, facilitate physical activity and social interaction, and have positive effects on mental health.	Lack of access to green open spaces reduces opportunities for physical activity and social interaction, and is associated with feelings of loneliness.	Households which lack ready access to green open spaces.
Social infrastructure			
Local schools and child care services	Schools and child care play a particularly important role in fostering social interaction and cohesion.	Lack of access to local schools and child care can hinder social cohesion and makes active transport to school/child care less likely, with corresponding health impacts.	Families which lack access to local schools and child care services.
Cultural, sporting, and recreational facilities	Relevant infrastructure encourages participation in activities that contribute to improved community health, community building, social cohesion and inclusiveness; and individual benefits including academic outcomes, self-esteem, social confidence, life skills, and enhanced physical and mental well-being.	Lack of access to sporting, recreational and cultural facilities impacts on physical activity and social cohesion, with both physical and mental health consequences.	Families and individuals who lack access to cultural, sporting, and recreational facilities.

Community connectedness			
Social connectedness and cohesion	Social connectedness and trust strongly predicts personal happiness and mental well-being as well as better physical health.	Lack of social cohesion is correlated with higher levels of stress, depression, and anxiety.	Individuals and families living in communities which lack social cohesion.
Community development outreach workers	Neighbourhood-based workers are proven to be an effective means of engaging residents and building strong community networks and social cohesion.	Lack of social cohesion is correlated with higher levels of stress, depression, and anxiety.	Households in neighbourhoods which lack community development outreach workers.
Social interaction	People with adequate social relationships have higher physical and mental health status than those without.	Lack of social interaction is equivalent with smoking and more influential than other risk factors for mortality, including obesity and physical inactivity.	Families and individuals lacking adequate opportunities for social interaction.
Perceived and actual personal safety	Perceived and actual crime and danger can impact on health through injury and stress, and by discouraging physical activity and social interaction.	Feeling unsafe in itself impacts on mental health, including depression.	Households in neighbourhoods that have high levels of crime or are not perceived to be safe.
Loneliness	Increased density, growth in the number of sole person households, and limited social connections among residents can result in loneliness. Encouraging “neighbourliness” through opportunities for social interaction mitigates against loneliness.	Loneliness has substantial health impacts including sleep deprivation and mental health problems including depression and anxiety.	People who are socially isolated.
Placemaking (community participation in shaping neighbourhoods)	Encouraging social interaction, community building, and civic engagement within a public space has important physical and mental health benefits.	Lack of access to such participatory activities denies access to their benefits including a greater sense of belonging, increased physical activity, and reduced rates of depression	Individuals and families who lack opportunities to participate in Placemaking.

		and psychological distress.	

Implications for Green Square development

In considering the implications of the health impacts of social infrastructure and community connectedness for the Green Square development, in addition to the findings of the literature review it is useful to examine the City of Sydney's consideration of the social infrastructure needs of Green Square residents as set out in the *Green Square Draft Infrastructure Strategy and Plan*; and the findings of the City's 2014 Green Square Community Survey.

Green Square Draft Infrastructure Strategy and Plan

As noted above, in March 2015 the City released the *Green Square Draft Infrastructure Strategy and Plan*, which includes significant consideration of social infrastructure (Section 7 of the Plan), with reference to research into future social infrastructure needs against benchmarks, commissioned by the City and undertaken by SGS Consulting (Appendix 2 to the Plan, with summary table reproduced as Appendix 1 to this report). Plans for the delivery of this infrastructure are discussed at Section 8 of the Plan.

The Plan acknowledges the importance of a range of social infrastructure and services in supporting community connectedness and the development of social capital, and lists the following key risks for Green Square:

- Provision of community facilities and services may not keep pace with population growth.
- Some services, such as education and health provision are not the responsibility of the City.
- Differing cultural backgrounds, beliefs and traditions can potentially lead to cultural isolation.
- Placemaking strategies and programmes may not respond to community needs.

Other key issues covered in Section 7 of the Plan are as follows:

- The City is committed to promoting community integration including through community development staffing and City Space teams. A key focus is the integration of the new Green Square community with the existing community.
- The City is committed to a Placemaking approach, particularly in making the Town Centre a unique destination point, and in developing a future Green Square that is a vibrant, sustainable village for people to live and work in. The City is developing a *Placemaking Framework and Action Plan* that focuses predominantly, but not exclusively, on the Town Centre.

- Facilities planning is informed by: the expected residential population growth; the needs of the dominant young adult and working age population; the growth in the numbers of young children in the area; the needs of working families with young children; the needs of the growing number of older people; the cultural mix (notably high numbers of people from Chinese and other Asian backgrounds); the needs of Aboriginal and Torres Strait Islander people living in nearby neighbourhoods; the need for "community living rooms" in this high density work/living environment; and the need for people from surrounding areas, including disadvantaged groups, to be able to access community facilities in Green Square.
- Priorities for facilities and services provision have been identified as: child care; integrated community hubs; cultural/creative facilities; indoor recreation facilities; library; and spaces and infrastructure for night time events.
- The City has developed a set of community indicators that have the potential to measure the success of infrastructure in Green Square compared to other areas of the local government area. The indicators cover five areas: social (healthy, safe and inclusive communities); cultural (culturally rich and vibrant communities); engagement (democratic and engaged communities); economic (dynamic, resilient, local economies); and environmental (sustainable environments).
- The City's *Child Care Needs Analysis Study 2013* identified that strategies were urgently needed to increase the supply of child care places across the City, including a gap of 353 places between supply and demand in Green Square and City South Village. The City has committed to investing $55 million to fast track the direct delivery of child care centres, as well as facilitating the delivery of new private sector centres.
- The City is committed to delivering the following community facilities: a library (by 2018); a community hub (by 2022); a creative centre (by 2017); a child care centre (by 2017); an aquatic and recreation centre (by 2019); and new parks and open spaces.
- A range of regional and other social infrastructure will need to be delivered primarily by the NSW Government, but also by the not-for-profit sector and private sectors, to meet the recommendations for future infrastructure provision (see Appendix 1). This infrastructure which falls outside the Council's remit includes primary and secondary schools, before and after school care, child care, TAFE, University, hospitals and primary health care services, GP services, children's health services, aged care, emergency services, and postal services. The City advocates actively for the provision of State level infrastructure.
- The City recognises that affordable housing is a critical part of the social infrastructure that will facilitate the social sustainable growth of Green Square and the City more broadly.

Green Square Community Survey

A community survey of Green Square residents was commissioned by the City of Sydney in 2014 in an effort to measure the nature of social cohesion and social interaction and identify opportunities and barriers residents face in contributing to social cohesion and community development; and to understand the wellbeing of residents and workers, including their satisfaction with and attachment to the area, their local area preferences and desires, and their plans for the future[3].Key findings of the survey included the following:

- The majority of residents (91%) agreed that the area was a good place to live, but fewer agreed that it was a good place to raise children (42%) or retire (27%).
- The most commonly mentioned reasons for moving to the area were proximity to the Sydney CBD (72%) and proximity to public transport (46%).
- Most (79%) of the residents who completed the survey had lived in Green Square for less than six years and the majority (76%) planned to remain living in the area for a number of years.
- The things people most commonly said they liked about living in Green Square were the convenience of the location, access to public transport, and public space, especially green space. People also liked the community or village feel in the area.
- The things people most commonly said they disliked about living in Green Square related to transport, especially heavy traffic and concerns about public transport, parking and road infrastructure and pedestrian safety. People also raised concerns about the limited number and/or variety of services and facilities in the area including shops, cafés and restaurants. Many people were also concerned about urban planning in the area, especially overdevelopment.
- The most commonly mentioned group of improvements residents wanted in Green Square related to transport management, especially improved traffic management (49%) and better public transport that connects to more areas of the city (43%), improved parking (31%) and safer conditions for pedestrians and cyclists (21%). The second most commonly desired improvements were economic, especially a wider variety of cafés, restaurants and bars (60%) and retail shops (41%).
- When asked how they would describe Green Square to a friend, people were most likely to describe Green Square as a convenient location, but many also talked about Green Square as a place of change. For some this change was seen as a growth in the potential of the area while others were concerned with overdevelopment and overpopulation.
- Only one third (29%) of residents were satisfied with the level of social interaction they have

with other people who live and work in Green Square, with the remaining 71% wanting more interaction, including 33% who had no interaction with other people in the area.

- While most people (89%) said they would help their neighbours, fewer (52%) thought their neighbours would help them. A third of residents (34%) borrowed things and exchanged favours with neighbours and 41% regularly stopped to talk with people in their neighbourhood.
- The most common ways in which people had contact with other people while in Green Square were socialising in their own or others' homes (67%) and socialising in cafés, restaurants and/or pubs (58%). Socialising in parks, on the street and online were also important. People were more likely to meet with others while attending events or participating in sport or recreational activities outside of Green Square than in the area.
- Most Green Square residents are not involved in formal civic activities such as volunteering, or participating in clubs and associations.
- A minority of residents felt they had made a civic contribution by working with others to improve the area (24%) or contributing to shaping Green Square (22%). Related to this, only 29% felt that their thoughts about local issues in Green Square could be heard by people who make a difference and only 17% agreed that there was strong local leadership in the area.
- The majority of residents felt safe or unconcerned in all situations except for walking in Green Square alone after dark, in which circumstance 23% of people felt unsafe or very unsafe.
- The services and facilities in the Green Square area most commonly used by residents were local cafés and restaurants (96%) and local parks (86%). Of formal community facilities, the Tote was the most commonly used facility (41%), with much lower use of other community or neighbourhood centres (12%) or the community hall (12%). More than a third of resident survey respondents had never heard of the Green Square Community Hall (34%), or the community or neighbourhood centres in the area besides the Tote (36%).
- The most common limitation people experience to socialising with others in the area is time constraints (52% often or all of the time). Other important limitations are difficulty in finding information about social activities (22% often or all of the time), not being sure what to talk to new people about (23% often or all of the time) and not being interested (27% often or all of the time).

The researchers concluded that the findings of the survey paint a picture of community with a high

proportion of time-poor people who desire more social interaction with others who live and work in the area. Of particular note, many respondents indicated that they had difficulty finding out what opportunities were available to them to socialise with other people in their area. While this group is relatively well informed of their civic rights and responsibilities, only a small proportion have become actively engaged in trying to improve their community and an even smaller proportion feel that their thoughts about the community would be taken into account by local leaders or others who could make a difference. The survey also highlighted the existence of smaller, yet significant, pockets of the population whose social interactions and participation are constrained by lower incomes, feelings of exclusion, and access and language barriers.

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The researchers made the following observations regarding the implications of these findings:

- *Implications for community development:* Interventions to encourage social interaction and cohesion in the community will need to be two-pronged. Interventions will be needed that cater to the needs of people on lower incomes experiencing language barriers and social exclusion. Interventions will also be needed to engage high-income but time-poor residents, who demonstrated a desire for greater involvement in social interactions, but are constrained because of a lack of knowledge about the opportunities available to them.
- *Implications for open space and public domain planning:* Parks and public spaces are significant locations for social interaction in Green Square. This could influence local land use planning and infrastructure development in Green Square and in future urban renewal areas, as it suggests that parks are more important than formal community spaces in facilitating local social interaction. Cafés, restaurants and bars, and local shops, were also important locations for social interaction, and residents spoke of their desire for more such facilities.
- *Implications for building design:* The survey results suggest that residential buildings are very important locations for social interaction. People's homes were the most important locations for social interaction in general, and the entrances to the buildings people lived in were the most important locations for incidental social interactions within Green Square. This points to the importance of ensuring that planning and building promote the provision of facilities that encourage positive social interaction in higher-density developments in particular.
- *Implications for place making:* Green Square is the location to which survey respondents felt the least attachment (less than to locations at both smaller and larger scales), and people felt more attached to the suburbs in which they lived than to the Green Square area as a whole. Survey respondents also often spoke about Green Square as a place that was

currently changing and likely to continue changing. This suggests that Green Square does not currently have a strong place identity and the area is in a state of flux.

Discussion and recommendations

The findings of the literature review above, as well as the responses to the Green Square Community Survey, are corroborated by the Future Communities work in the UK, which has identified several key considerations for community building in urban growth areas[64]:

- New communities need services and support, not just buildings.
- Lack of social infrastructure affects community well-being.
- Poor design and lack of amenities has long term financial and social costs.
- Early provision of social infrastructure is crucial.
- Schools play a distinct role in supporting new communities.
- Good transport connections matter.
- "Meanwhile spaces" – temporary facilities – work for new communities, while they grow.
- New communities need to provide for all generations in both amenities and services, and appropriate housing types and tenure.
- Eco-friendly infrastructure needs to be incorporated into physical infrastructure design.
- Design has a role in helping communities to be healthy.

These issues are all relevant to Green Square. Key recommendations for the City of Sydney, to help ensure that the community and social infrastructure for the Green Square development maximises opportunities for individual wellbeing and community connectedness and cohesion, with consequent health benefits, are as follows.

Implement a range of strategies to build social connectedness and community cohesion

It is notable that the community survey indicates that less than one third of residents were satisfied with the level of social interaction they have with other people who live and work in Green Square, while the remaining residents expressed that they wanted more interaction, including one third of residents who had no interaction with other people in the area. Social connectedness and trust strongly predict personal happiness and mental well-being as well as better physical health, while lack of social cohesion is correlated with higher levels of stress, depression, and anxiety. Social isolation and loneliness have serious mental and physical health consequences. Opportunities for social interaction are critical to building community connectedness and these opportunities can be

maximised through appropriate urban design and building design along with other hard infrastructure; provision of key facilities; support services including community outreach workers; and opportunities for community members to participate in neighbourhood building.

Provide a well-planned public domain

A well planned public domain, including aesthetically pleasing buildings and infrastructure, shade and greenery, public art etc. can promote physical and mental health by contributing to social interaction, physical activity, and feelings of safety.

Provide social infrastructure from the early stages of urban development

Early provision of social infrastructure is crucial in building a sense of community, and temporary facilities may be needed pending the development of long-term infrastructure.

Maintain the built environment and public infrastructure

Upkeep and maintenance of the built environment and public infrastructure is important as this has an impact on social interaction, feelings of connection, feelings of safety, and levels of stress.

Consider urban design and building design which promotes social interaction

Urban design and building design which includes common entries and common areas within and around dwellings promote social interaction, supporting community connectedness and positive mental health. The community survey confirms that entrances to the buildings people lived in were the most important locations for incidental social interactions within Green Square. Built form which complements the existing character and heritage of the local area can also be important in promoting a sense of community.

Consider urban design and building design which promotes actual and perceived safety

Urban design and building design which promotes actual and perceived safety is important. Perceived and actual crime and danger can impact on health through injury and stress, and by discouraging physical activity and social interaction. Walking in Green Square after dark was identified in the community survey as an area where improvements to people's feelings of safety are needed.

Implement strategies to promote active and public transport, and to minimise private car use

The community survey indicates that transport, especially heavy traffic and concerns about public transport, parking and road infrastructure and pedestrian safety, is a major concern for residents of

Green Square. Residents are calling for improved traffic management, better public transport that connects to more areas of the city, improved parking, and safer conditions for pedestrians and cyclists. It is critical that an effective transport strategy is developed which encourages uptake of active and public transport, and minimises use of private vehicles. This strategy must include separated walking and cycling paths, proximity of key destinations, and adequate and connected public transport. This will respond to residents' concerns and will have important physical health benefits as well as encouraging social interaction.

Minimise exposure to noise pollution

The community's exposure to noise pollution, which can arise from road traffic and other sources, should be minimised as this can impact negatively on mental health, including depression.

Ensure good access to a diversity of parks and open spaces, cafes, restaurants and shops

The community survey indicates that parks can be more important than formal community spaces in facilitating local social interaction; and that cafés, restaurants and bars, and local shops, were also important locations for social interaction, and were keen to have more such facilities. A diversity of open spaces should be considered to encompass the needs of children (e.g. playgrounds), young people (e.g. skate parks, basketball courts), families with pets (e.g. dog parks), older people (e.g. safe walking paths with seats and other amenities), as well as allowing for activities such as community gardens which promote social interaction and community building.

Ensure good access to green open spaces

Access to green open spaces is particularly important. Green open spaces clean the air, buffer noise pollution, facilitate physical activity and social interaction, and have positive effects on mental health. Conversely, lack of access to green open spaces reduces opportunities for physical activity and social interaction, and is associated with feelings of loneliness.

Support access to healthy food outlets and minimise access to unhealthy food outlets

Planning regulations and permits should support access to healthy food outlets, as opposed to a proliferation of fast food outlets, is important in promoting healthy eating and helping people in the community to maintain a healthy weight.

Ensure good access to local schools and child care services

Local schools and child care services are also particularly important in building community connectedness and cohesion. Lack of access to local schools and child care can hinder social

cohesion and makes active transport to school/child care less likely, with corresponding health impacts. Planners often assume that once couples have two children they will move out of apartments, but a range of factors including a lack of affordable alternatives and the development of social networks may see families staying in the area long term. Planning for an adequate number of schools while there is still available land is imperative. Coupled with dislocation from extended family, there is also an increased need for child care, including before and after school care and school holiday care. Schools and child care should be local and close to where people live, to encourage active transport to and from school as well as the building of local social networks.

Ensure good access to cultural, sporting, and recreational facilities

Appropriate cultural, sporting and recreational facilities contribute to community wellbeing by encouraging participation in activities that contribute to improved community health, community building, social cohesion and inclusiveness; and individual benefits including academic outcomes, self-esteem, social confidence, life skills, and enhanced physical and mental well-being.

Continue to implement a Placemaking approach, and communicate well with the community

Placemaking is an important approach, as encouraging social interaction, community building, and civic engagement within a public space has important physical and mental health benefits. Currently, only a small minority of residents in the community survey feel they have contributed to shaping Green Square, and fewer than one third felt that their thoughts about local issues in Green Square could be heard by people who make a difference. Targeted communications with the community that provide clear and accurate information on higher density development, including potential community benefits, is also recommended to support community building.

Work to build a sense of community identity

As noted in the analysis of the community survey, the Green Square community does not currently have a strong sense of identity, and interventions to encourage social interaction and cohesion in the community will need to be two-pronged, to cater both for the needs of people on lower incomes experiencing language barriers and social exclusion, and the needs of high-income but time-poor residents.

Respond to the needs of the diverse and changing population

Social and community infrastructure planning should take into account the diverse population (in terms of age, ethnicity, and other factors), and the likelihood of a changing demographic over time. For example, as noted above, the community survey indicates that while local people see Green

Square as a good place to live, the majority do not see it as a good place to bring up children or to retire. Child care and school facilities are important in improving this situation, but equally, older people will need access to suitable health care and aged care services, community support services and cultural facilities.

Conclusion

This report has demonstrated that the provision of social and community infrastructure – or the lack of an adequate infrastructure – can have major impacts on the physical and mental health of members of urban communities, and on the level of community cohesion. It is recommended that the City of Sydney take appropriate action, as outlined in the recommendations above, to ensure that opportunities to build a strong and healthy Green Square community are maximised.

Appendix 5.1: Recommendations for future provision of social infrastructure in Green Square[90]

Service/	Benchmark	Future Provision Requirements
Primary Schools	1 primary school for 500 students.	Assuming every child in Green Square and City South Village attends a public primary school, **at least one new primary school is needed currently and four new schools needed by 2031.** Alexandria Park Community School is the local school and will have an increased capacity from 320 students to 2200 students from kindergarten to year 12. DEC has advised the City it has capacity in existing buildings to accommodate projected increases in primary
Secondary Schools	1 government high school for up to 1200 students	Based on the benchmark, the Green Square City South Village may require another secondary school by 2031, or expand capacity within the existing secondary school. DEC has advised the City that a new secondary school will be built on the Cleveland St English
Before and After School care	1 place for every 25 children aged 5-12 years.	Using 45 children for each before and after school care, **an additional one –two before and after school care facilities are required by 2031.** This should be linked to provision of new primary schools.
Childcare	As in separate Child Care Needs Analysis Report 2013	There are nine day care centres located in Green Square City South Village with a total capacity of 396 (averages 44 spaces per centre). The projected gap between child care supply and demand in the Green Square & City South village is:353 places in 2013, 617 places in 2016, 1079 places in 2021, 1440 places in 20311

TAFE	1 TAFE to cater for a population of 300,000 – 500,000	Even using the low provision rate of one TAFE per 300,000 people, it is possible to conclude that there is no projected demand for a TAFE campus within Green Square and City Switch Village. It is important to consult with key state and regional bodies on the provision of new campuses on a regional scale.
University	1 university for every 150,000 people	Using the benchmark of providing one university for every 150,000 people, and four Universities within a 6km radius there is no demand for an additional campus. It is important to consult with key Commonwealth, State and regional bodies on the provision of new campuses on a regional scale.
Hospitals	2.3 beds per 1,000 people	Using the benchmark of 2.3 beds per 1000 people, it is likely that by 2031 an additional 124 beds will be required by the Green Square and City South Village population. The high number of elderly people projected may increase this demand. **These additional beds could be provided in an existing hospital or in a new Health care facility.**
Primary Health Care Centre (including mental health)	1 new primary care centre per 50,000 people	Benchmark is 1 new centre per 50,000 of the population, so the Village will not require any additional centres through to 2031. Note, however, the inner city location of Green Square, means centres may be utilised by people who work nearby.
GP Medical Centres	1-4 GPs per 4,000 people	A high number of elderly people, young children and/or disadvantaged groups will increase this demand. Some residents may access GPs outside the area near their place of employment. **Based on a mostly working aged population with few children there may be demand for 15-80 full time GPs by 2031. Demand could increase significantly as the population ages and as more young children populate the area.**
Children's Health Services	1 early childhood nurse per 2,000 children	Benchmark for providing one early childhood nurse per 2,000 children, shows there is existing demand for one child health nurse (2011 data). **This increases to three by 2031.**
Aged Care	88 places per 1000 people 70+	Using the benchmark of 88 aged care places per 1000 people over 70+, there will be a need for 257 extra beds for City Switch and Green Square residents by 2031. Existing facilities could accommodate some of this. **However projected growth of people aged over 70 in Green Square and City South, support demand for an additional facility within the area.**
Ambulance Services	1 ambulance station per 105,000 people	The benchmark is one ambulance station per 105,000 people. It is possible that by 2031, one new ambulance station may be required in Green Square and City South.

Fire Services	1 fire station for every 60,000 people	The benchmark of one facility for every 60,000 people, by 2031 there will be adequate provision of fire services for Green Square and City South Village.
Police	1 police station for every 108,000 people	Using the current benchmark of one police station for every 108,000 people, no new police stations will be required by 2031.

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