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Reimagining... the Liverpool Health, Education, Research and Innovation Precinct



This report was commissioned by The Liverpool Health, Education, Research and Innovation Precinct Committee. It represents an alliance of stakeholders comprised of:

- South Western Sydney Local Health District
- Liverpool Public Hospital
- South West Sydney Primary Health Network
- Ingham Institute of Applied Medical Research
- Sydney Business Chamber
- NSW Health Infrastructure
- Liverpool City Council
- TAFE NSW
- University of Wollongong (UOW)
- University of New South Wales (UNSW)
- Western Sydney University (WSU)

The Committee is commissioning a functional and viable strategy to successfully ensure Liverpool’s future growth and eminence.

The Committee is working in collaboration with:

- The Committee for Sydney
- NSW Department of Education
- The Greater Sydney Commission
- KJA
- Healthcare Property Group



Foreword from the Liverpool Innovation Precinct Committee

Health and education already plays a significant role in Liverpool.

The Liverpool city centre already contains a number of substantial and innovative organisations and facilities including Liverpool Hospital, Ingham Institute of Applied Medical Research, a clinical skills and simulation centre, the clinical schools of the UNSW and WSU, South West Private Hospital, and TAFE NSW.

There are more than 15,000 health and knowledge workers, already in the Liverpool local government area (LGA), which equates to 20% of workers. At the current rate, by 2036, the Liverpool LGA should contain around 30,000 health and knowledge workers, almost 25% of the workforce.

With a focus on developing this area as a growth precinct this number should be even higher by 2036.

The challenge is to maximise the potential of existing Liverpool organisations (see Appendix D), and to provide an environment for new investment.

This document sets out an aspirational vision for the future development of the **Liverpool Health, Education, Research and Innovation Precinct (the Liverpool Innovation Precinct)**.

The vision and its implementation represents a differentiation of Liverpool from other Australian health and education precincts, given that all are competing for talent and investment. Differentiation manifests itself in terms of the inherent nature of the Liverpool region (commercial land availability, a river city identity with a strong identity, lower relative cost of housing, existing and future transport connections, a diverse and growing population, etc) but most importantly also the way in which the Precinct participants work together.

As you will see from this report, the key to making the Liverpool Innovation Precinct distinct and to generate a step-change in impact is to foster a true sense of collaboration between Precinct participants.

The Liverpool Innovation Precinct should not simply represent the location of health and education institutions in Liverpool; it needs to reflect a rethinking of the way that we educate, and provide health services and research in an age of digital disruption and emerging technologies and industries. This is not a simple exercise, but it is one that offers a real chance for Liverpool to attract new jobs and opportunities.

In this context, we suggest that the Precinct's Vision Statement be:

The Liverpool Innovation Precinct is reimagining ...

This vision is open-ended, because we should not feel bounded.

That is, we envisage that the Precinct will be reimagining: how health, education and research is undertaken individually and collaboratively to drive innovation; the industries that will drive the Liverpool economy; the technologies that will underpin the next wave of progress; the public's perception of Liverpool as a economic entity; and so much more.

* 'Healthcare and Social Assistance' and 'Professional, Scientific and Technical Services'

What can a reimagined future look like for the people of Liverpool?

The Singh siblings – 19 August 2029

Jasmine was enjoying her 15 minute cycle along the bank of the Georges River to the Liverpool city centre with her brother, Arun, on an early Spring day.

As the Liverpool city centre came into view her mind drifted off to how much it had changed over recent years. Much of the city centre was now facing the Georges River and the move to pedestrian-first meant that the city centre now had a buzz with a vibrant 24x7 cafe and restaurant scene. It was a place to which she wanted to go and did not fear being stuck in traffic gridlock.

Jasmine had been a foundation student at the Liverpool P-Tech STEM school having transferred into the school in year 10 in 2021, with her brother, Arun, following four years behind.

Her parents had always wanted Jasmine to pursue a medical or health subject at university, but it was not until her time at P-Tech that she had developed a real desire for it, driven by her exposure to some of the amazing work being done by the Liverpool Hospital and the Ingham Research Institute in the field of diabetes. The work experience opportunities provided her the broader vision as to what she could do and how she could make a difference. Jasmine had been accepted to universities elsewhere in Sydney and in Melbourne, but she had decided to stay in Liverpool, attracted by the collaborative opportunities and being close to her family and friends. She chose to study Medical Science at UNSW, but was thrilled to have the opportunity to have exposure to some complementary subjects, also

provided in the Precinct, by WSU and the UOW. Similarly, her study was shaped by the close industry relationships that she forged with researchers, academics and corporates in the Precinct. They all had their own interests, but it was if they were all working collaboratively for the common good.

Her brother, Arun, had forged a different path. His eyes had been opened up to robotics as he had done some futuristic training through VET at TAFE NSW, which inspired him to study engineering, robotics and mechatronics at WSU. This blend of theory and practical industry engagement eventually led him to start his own business at LaunchPad, while continuing to engage with his academic supervisors. Through early funding from the new pharmaceutical company that is looking to scale up its distribution facilities and a world class link between Moorebank Intermodal Hub and the recently opened Western Sydney Airport (WSA), Arun is excited to see where he can take his company. He is also pleased to study at Liverpool as his girlfriend, Tien, is at the UOW studying nursing.





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Summary

1

Liverpool's city centre as an 'innovation district'

Liverpool has the aspiration for its city centre to be a hub for innovation.

A new model of successful health centred innovation districts is emerging, dubbed 'innovation districts' by the Brookings Institute (Katz & Wagner 2014).

Innovation districts are geographic areas where...



Leading-edge anchor institutions are present



Companies cluster and connect



All are physically compact



Accessible via transit



Are technically-wired



Offer mixed-use housing, office and retail

By their very nature, these districts are vibrant and 'sticky' communities where people want to be, both from a work and non-work perspective. In this way, the focus on the business of innovation builds a stronger local community in which people see their future in terms of both living and working.

The challenge is that Liverpool city centre is competing with other potential 'innovation districts' to capture the right anchor tenants, the investment to ensure that the city is connected, and the human talent. Some of this competition is very nearby in the centre and west of Sydney.

Hence, Liverpool needs to bring a differentiated offering to the table.

A key advantage for Liverpool is that the Liverpool city centre has the characteristics that resemble a Brookings Institute 'innovation district', differentiating it from most other claimed Australian innovation districts.

A significant benefit of the existing Liverpool Health Precinct is its close proximity to the Liverpool central business district (CBD). Unlike most other hospital locations, the Liverpool Innovation Precinct is within a short stroll to Liverpool's city centre providing unparalleled accessibility to all the services and benefits associated within a major commercial hub.

In addition, a number of significant government sites, including those owned by the NSW Department of Education and TAFE NSW, are located adjacent or nearby the Liverpool Hospital.

Integrated planning achieved through partnerships exploring joint use opportunities could deliver positive outcomes and public benefit within a new Health and Education Innovation Precinct.

The existing elements that distinguish the Precinct are its location and environment. The Precinct itself is:

- in a city centre environment, of which it is (and will further be) a significant part of the activity (i.e. rather than being a Precinct at the edge of a much broader CBD, or in a Science Park context)
- at a transport hub, served by three train lines, and the closest city centre to the planned Western Sydney Airport (WSA). The Precinct already has accessibility the envy of many greenfield precincts.

The potential for further distinction comes from a commitment to collaboration by the participants within the Precinct. While it is possible to see similar institutions to those in Liverpool forming precincts elsewhere, what tends to occur is co-location within a precinct, but there is rarely any operational:

- co-location – intermingling of facilities (e.g. shared facilities) rather than simply physical location next to each other. The city centre environment, with significant future developments to support existing and new health and education providers, means that the sharing of operations can be designed into future plans (in addition to possible retrofits).
- collaboration – operating in a way whereby each participant is dependent on one or more other participant for delivery. This can be by, for example, sharing of data, facilitating education and career pathways, joint collaboration on research, etc).

The emphasis then becomes one of rethinking – or reimagining – what will be different in the Precinct to maximise the economic opportunities for Liverpool and the community more generally.

The vision for the Liverpool Innovation Precinct

Reimagining ...



The Liverpool Innovation Precinct is reimagining ...

- how health, education and research is undertaken individually and collaboratively to drive innovation
- the industries that will drive the Liverpool economy
- the technologies that will underpin the next wave of economic progress
- the public's perception of Liverpool as an economic entity

Reimagining the role of health and research in the Precinct

Building on current strengths, the Liverpool Innovation Precinct will grow its health service delivery footprint using public and private collaboration with cancer care and translational research and education as the flagships of the Precinct. The Precinct will also leverage its position in Liverpool as a hub for healthcare robotics and advanced manufacturing and will support the broader logistics hub for health and medical products. This will be driven by strong public-private collaboration across the Precinct, supported and enabled by digital technologies.



Establishment of the Precinct as a **Centre of Excellence for Cancer and Translational Research and Health Technology**. This will leverage existing strengths in cancer services and implementation of current edge technologies across health delivery (benefiting the entire patient journey), research, and education and training.



Further **expansion of the hospital complex** through the vital next stage development of the Public Hospital and the co-location of a Private Hospital. This development will allow health services at Liverpool to meet the challenges of a population growth rate that is double that of NSW.



'Open' as the default model to attract investment. This includes: easy access to integrated health information; streamlined and easy access to take innovative ideas and products into the population; streamlined clinical trials; and access to material and samples to support research.



Development of an advanced manufacturing, automation and logistics hub for the manufacturing of components for medical devices, health related technology and prosthetics and healthcare logistics, leveraging Liverpool's manufacturing workforce profile, research and transport links.



Health, education and research integration to enable innovation and collaboration across Precinct partners and with the Liverpool community. This would occur through digital platforms and operational, facilitated collaboration.

Reimagining the role of education in the Precinct

With collaboration as an overarching principle, the Precinct's education bodies (early education, public and private schools, vocational trainers and universities) should be encouraged to rethink how they can individually and collectively deliver relevant and improved educational outcomes. This can be done by:



Each **educational institution** will focus on their own strength areas and build on each others. This will require explicit collaboration/curation to maximise the value of the Precinct. For example, this may include enhanced access to seamless cross-institutional study within the Precinct and ultimately joint degrees/research.



Building progression pathways and a coherent curriculum from early childhood upwards that includes both vocational and non-vocational learning. The Precinct's industry partners should seek to offer work related experiences for all students and researchers.



Ensuring that curriculum and delivery is project based from the start. This can be facilitated by harnessing educational technology (ie edtech), to strip out simple knowledge accumulation to focus on project based teaching and peer learning.



Having a demand-driven offer for students **focused** on current and future needs of the labour market (eg an enhanced STEM focus) and inward investment. In effect, planning should be on the basis of jobs and future work, with employers (eg including Precinct participants and future investors) providing input to curriculum and delivery.



Entrepreneurship as a key part of **learning**, particularly to ensure that research is commercialised. Teaching and enabling students to think creatively to solve important problems and to grow these ideas at all ages and at all stages within the innovation lifecycle.

Reimagining the place potential of the Precinct

Liverpool has a well defined core and a concentration of activity in the city centre, it's strength is in its local feel. Liverpool has the potential to be a premier 'college town' where education is the linking element that ties the city together. It provides a place where people want to settle for life as well as a place that is alive and consistently attracts new talent.



Liverpool builds on its strong civic character by optimising development in the city centre that supports **clear urban design framework**, material character and development brief.



A **vibrant city** is built from considering **activation** of streets along main desire line routes, the fostering of after hours entertainment and social catalysts.



Collaboration and cooperation are optimised by co-location, shared facilities and **clear physical links** between anchor institutions.



A **Life Long** approach to living in Liverpool through catering for all ages and all lifestyle choices, ensuring a mix of housing options, activities, work and **social and economic inclusion**.



Health outcomes are considered in **every urban decision** emphasising public transport modes over car travel, enhancing green space.

2A

*Regional context of the Liverpool
Innovation Precinct*

What kind of city is Liverpool today?

Liverpool has a distinct identity and is growing quickly



“I love the historical, the new and the multicultural flavour to our city. Casula Powerhouse, Bigge Street Park and St Luke’s Anglican Church”

Marion, Green Valley

Liverpool already has significant aspects of interest that create an identity for the area. When developing a vision these existing aspects should be enhanced and developed to ensure the new vision is grounded in an authentic reality. There are many existing residents who love living in Liverpool and the challenge is how to grow and build on these elements that already make Liverpool distinct a great place to love.



What kind of city is Liverpool today?

Liverpool has a distinct identity and is growing quickly

Liverpool is:



A Regional City

It is 35km from the CBD. The population density of the Liverpool LGA is relatively low at 44.6 persons per hectare while the Liverpool City Centre has a population density similar to Pyrmont (at 154.3 persons per hectare).



A Heritage Area

It is one of the oldest cities in Australia. Settlement in the area dates back to 1810. It was named after the Earl of Liverpool who was Secretary of State of the colonies at the time.



A city with strong manufacturing, health and education industries

Currently there are key manufacturing industries established in the city while the health and education industry is growing.



An Aerotropolis opportunity

Liverpool is within a priority growth area adjacent to the proposed WSA and Parramatta.



Young

A significant proportion of the population is under 30 and there are more families with kids compared to the rest of Sydney.



Diverse

Liverpool in the 1990s experienced the highest intake in overseas arrivals. In 2011, 22.3% of the Liverpool population were born overseas.



Transport Enabled

Many people who live in Liverpool travel outside the area and are reliant on cars for transportation.



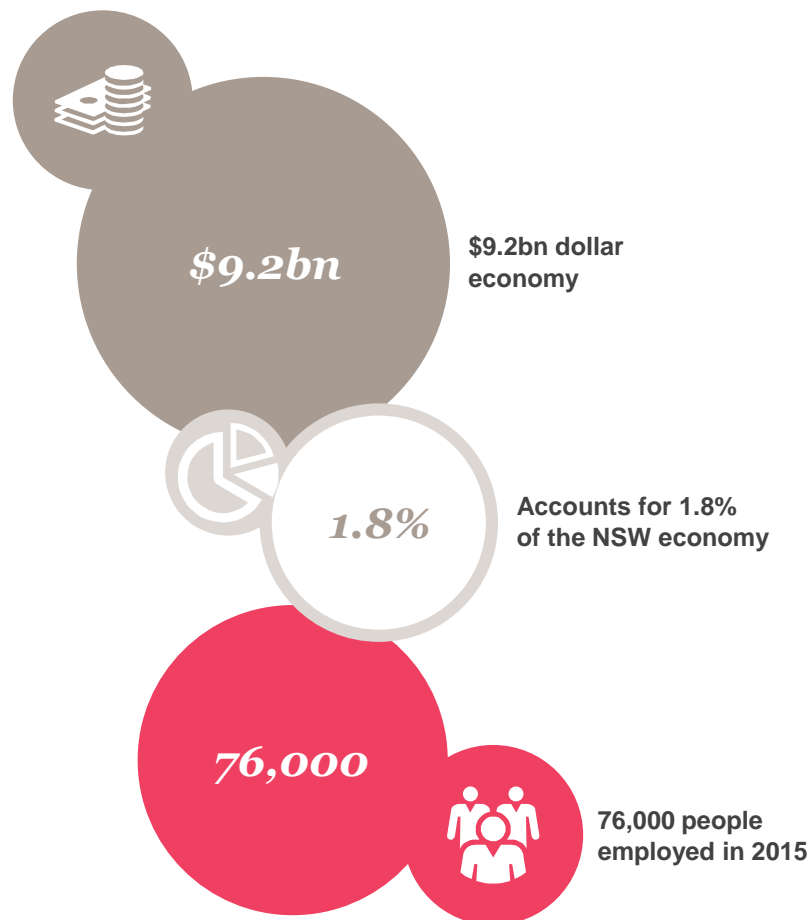
Green

A significant proportion of its land is rural or recreational.

Regional Context for the Liverpool Innovation Precinct

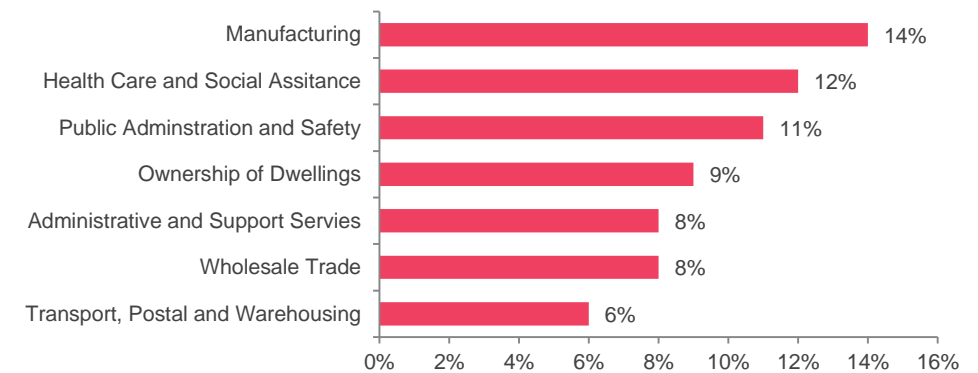
Liverpool is already a centre for significant economic activity

The Liverpool LGA is already a major commercial centre in NSW.



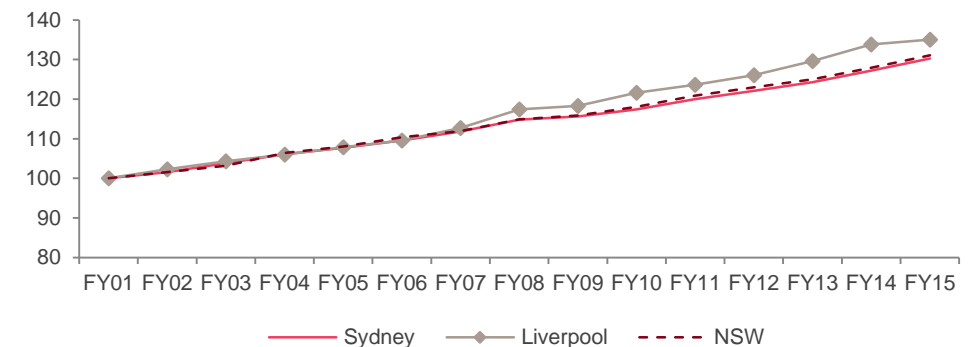
As shown in the figure below, Liverpool is a strategic centre for health and education, population-driven services, manufacturing and knowledge intensive jobs.

Industry composition (GVA, FY15)



Indeed, since the 2007 financial year, the Liverpool LGA has grown its economic contribution faster than the rest of Sydney and the broader NSW.

Growth (economic output, index)



Regional Context for the Liverpool Innovation Precinct

Liverpool is well positioned to prosper

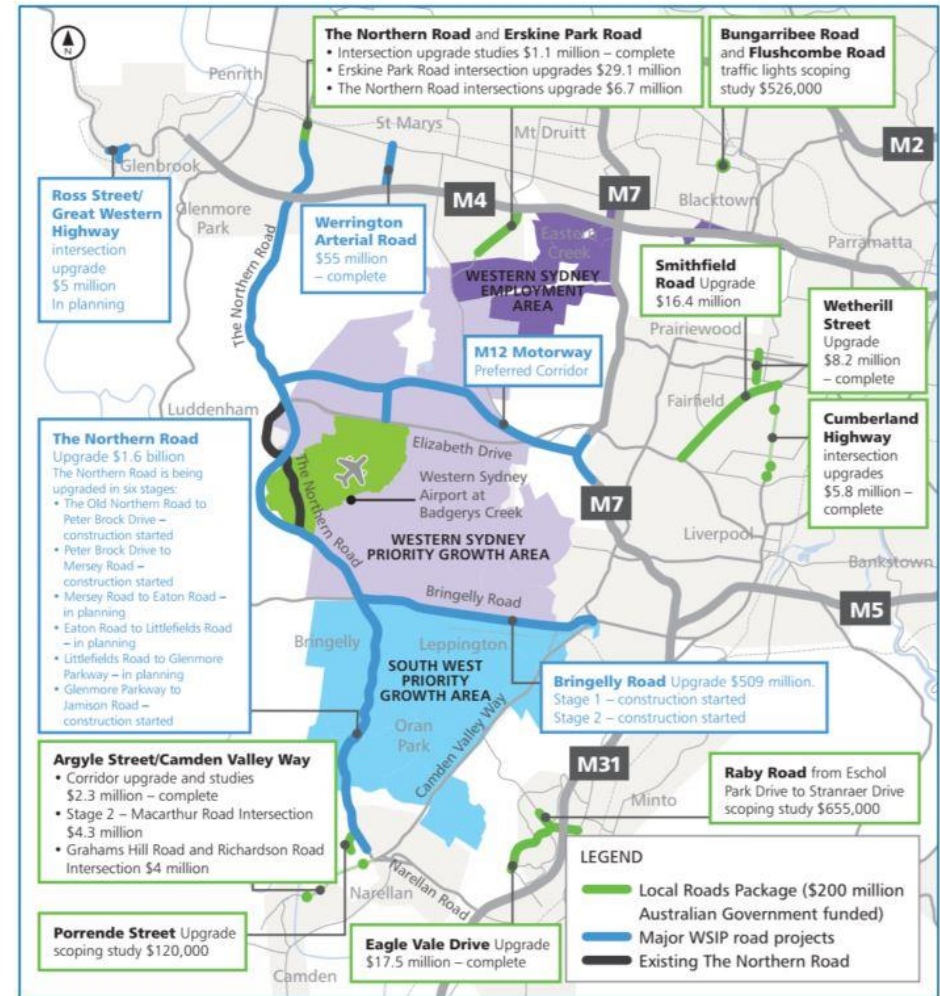
With the approval of the WSA, the Greater Sydney Commission's (GSC) Draft South West District plans, and a significant infrastructure pipeline (detailed in appendix B), Liverpool is well-paced to benefit from this once in a generation infrastructure injection.

Geography and demographics also add to Liverpool's strong potential:

- the Liverpool Innovation Precinct is strategically positioned in the corridor between Sydney's two international airports, with access supported by large scale infrastructure investment that includes the Western Sydney Infrastructure plan (see next figure) and M5 upgrades.
- its young resident population is educated, entrepreneurial and from diverse cultural backgrounds (representing over 150 Nationalities, with a strong Arabic, Indian and Vietnamese influence).
- it is endowed with significant recreational and industrial space, both crucial pull factors to attract businesses and workers.

The development of the WSA and significant transport investments represent the new opportunities for Liverpool.

The new WSA provides a particular opportunity for Liverpool in a number of ways. The Australian Government forecasts that about five million people will use the WSA in its first year of operation from 2026, with annual passengers projected to increase to about 37 million by 2050. Ultimately, WSA will have the capacity to cater to more than 80 million passengers per year (GSC 2016). This scale of activity will induce a range of investments in Liverpool and across Western Sydney more generally.



Liverpool is equidistant between Kingsford Smith Airport and the WSA.

Image: 'Western Sydney Infrastructure Plan', RMS

Reimagining the Liverpool Innovation Precinct

Regional Context for the Liverpool Innovation Precinct

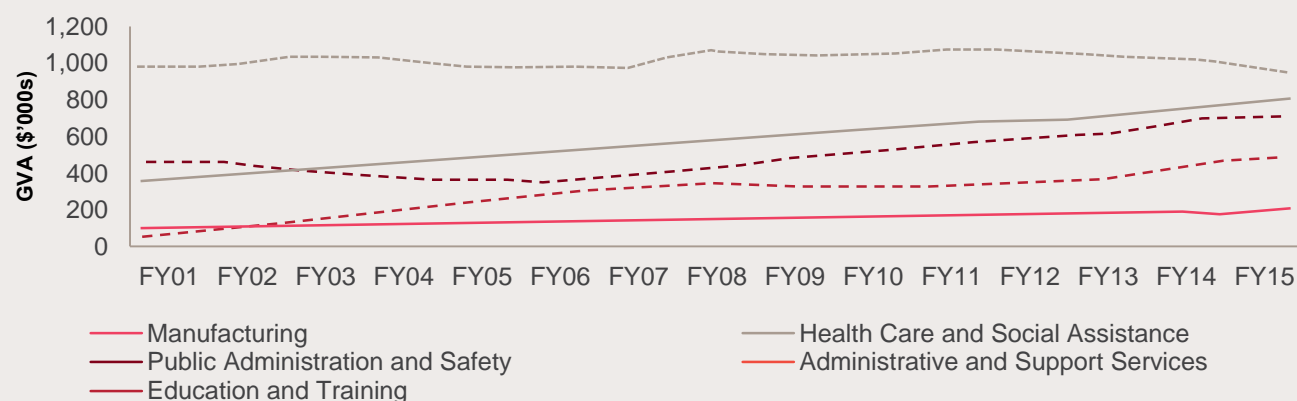
Simple accessibility by people, while enhanced compared to existing arrangements, is unlikely on its own to trigger a wave of new opportunities in people-centric activities (eg medical tourism, overseas students, conferences, etc.) in the Precinct.

Where the WSA is likely to be of most benefit to the Precinct is two-fold:

- As a focal point to encourage the development of educational products addressing the logistics industry. The confluence of a new airport, with close proximity to major road and rail routes merging at the Moorebank Intermodal Terminal, provides a real opportunity for best practices to be developed and embedded through new training offerings.

- Indeed, a sub-focus in the Precinct (by both universities and TAFE NSW) on logistics (from operational planning through to robotics and automation) can be positioned with the inevitable private sector logistics investment that will need to be made at the WSA and Moorebank as a world class offering that is attractive to both domestic and international students.
- As a hub for the delivery of (possibly time-sensitive) medical supplies and products (e.g. biomedical products). Liverpool has a strong history in manufacturing (see figure below), with health services likely now a more significant economic driver. Hence, a focus of the Precinct could be on harnessing local manufacturing expertise with the Precinct's health and R&D support, to facilitate a renewed industry. This can leverage Australia's reputation as 'clean, green and safe' with access to industry global supply chains through the airport.

GVA of top industries (2001 – 2015)



Liverpool needs to be cognisant of the fact that the airport will also benefit other regions around it. Undoubtedly the airport will trigger a wave of ancillary investment to other regions that result in competition for the city (e.g. the proposed Sydney Science Park).

The strength of the Precinct's offering as a true innovation district (i.e. rather than just another science/technology park disconnected from the community) needs to be reinforced as a differentiating factor, and that the collaborative behaviours within the Precinct are meaningfully different.

2B

Health and research vision

The health, research and education players in Liverpool today

There are a range of partners within the Liverpool area delivering world class care, education and research. An overview of each organisations's current priorities and investment within Liverpool is outlined in Appendix A. These organisations include:

- Liverpool Hospital
- Three university campuses –WSU, UNSW and UOW
- Ingham Institute of Applied Medical Research
- TAFE NSW
- Sydney SouthWest Private Hospital
- NSW Department of Education

The Precinct already delivers health services to the Liverpool community and beyond, supported by translational research, community of practitioners, researchers, workers and students.

The anchor of the Liverpool Innovation Precinct as a health and research hub is Liverpool Hospital. Liverpool Hospital is a highly evolved academic focussed acute hospital.

The hospital plays a role as a District hospital for the local catchments of Liverpool and Fairfield and as a tertiary referral hospital for all of South Western Sydney Local Health District (SWSLHD), and beyond for quaternary services. It has the highest number of emergency department presentations in NSW, is second only to Westmead in inpatients treated, is one of seven major trauma units in NSW for adults and one of only three adult Brain Injury Rehabilitation Units in Sydney.

Liverpool Hospital has principal tertiary affiliations to the UNSW, UOW and WSU; and also provides an active education programme for medical practitioners,

nurses and other health professionals; and offers a range of clinical placements for students from universities around Australia.

As a major teaching hospital, Liverpool Hospital is the key hospital for UNSW South Western Sydney Clinical School (SWSCS), an existing partnership between SWSLHD, Ingham Institute and WSU which includes the training of medical, nursing and allied health interns from UNSW and WSU. UOW also has medical, allied health and nursing students with plans to establish a nursing school in 2020. Through the clinical school over 387 students from the UNSW undertake clinical placements and there are 100 medical and allied health interns from WSU.

The SWSCS manages the Ingham Institute Clinical Skills and Simulation Centre at the Liverpool Hospital campus which is a training hub for researchers, students, nurses and clinicians from the SWSLHD, and partners WSU and UNSW. This centre includes state of the art high- fidelity robotic patient mannequin and simulated operating theatres.

Governance across the universities and Local Health District supports the integration of health, research and education with over 5000 conjoint positions with UNSW alone.

The collaboration of health, research and education partners within the Liverpool area is evident through the South West Sydney Research and the Sydney Partnership for Health, Education, Research and Enterprise (SPHERE). This NSW health and research hub and Academic Health Science Partnership provide strong governance and resources to support collaboration as well as provide access to Medical Research Futures Fund.

Through the Ingham Institute there is a focus on five streams of research within the Liverpool region: cancer research clinical sciences, population & health services research, injury and rehabilitation and mental health research.

Examples of some of the hundreds of research and health partnerships across the Precinct include:

- The hospital is rapidly assuming a global role in technological innovation through Resuscitation with Angiography, Percutaneous Techniques and Operative Repair suite (RAPTOR) hybrid surgical theatre and interventional radiology suites used to operate on critically ill emergency trauma patients.
- It provides many high technology services and is evolving to national and international prominence, with the only cyclotron in western Sydney and one of only four Magnetic Resonance imaging (MRI) Linear Accelerator (Linac) research facilities in the world. MRI-Linac research at the Ingham Institute – looking at improving cancer treatment through real-time image guided adaptive radiotherapy.
- Numerous clinical trials across the spectrum of clinical specialities including medicinal cannabis, medical oncology and palliative care.

A range of industry players are also established in the area through collaborations with tertiary institutions, TAFE NSW and other stakeholders such as the GP Super clinic located on Speed street.

This is an incredible foundation for the future of the Liverpool Innovation Precinct as a world class collaborative health service delivery, research, education and innovation precinct.

Health as a growth industry in Liverpool

Liverpool has a growing and diverse population. The profile and trends of the population of Liverpool and the broader South Western Sydney (SWS) region provide a range of opportunities and challenges that define the context for the Liverpool Precinct. Combined, these make health a growth industry for Liverpool and supports the culture of innovation in Liverpool.



Strong population growth

South Western Sydney (SWS), in particular Liverpool, is Sydney's fastest growing region, with significant growth expected over the next 20 years fueled by infrastructure and housing investment. NSW Department of Planning and Environment estimates that the population of SWS will increase to 986,250 people by 2031, an average of 13,000 new residents per annum. By 2036, it is projected that the local community will have grown by 52%, (715,000 people in 2016; 1,088,000 people by 2036), greater than the NSW rate of 28%.

The population growth will result in increased demand for health services, specifically hospital emergency presentations and admissions. Some of the increased physical capacity will be met through the Liverpool Hospital Stage 2 Redevelopment. This will require more trained health professionals to deliver the increase in care needs, both within the hospital and in the community.

In addition to building capacity through redevelopment, there is also a need to look at innovative models of care outside of the acute and subacute hospital services. For example, integrated health and larger focus on prevention and wellbeing can be delivered in the community and closer to people's homes to minimise the escalating demand for hospital services.

The Precinct will cater for increased demand for healthcare and wellbeing services and will further develop a skilled local workforce to support the health demands of the growing population.



Changing demographics

The Liverpool area has a diverse and changing community, There is a breadth in language and cultural groups with over 150 languages spoken in the region. 37% of people living in SWS were born overseas and 40% speak only English at home compared to 73% for NSW. Part of this group are humanitarian arrivals, with South Western Sydney welcoming the largest proportion of humanitarian arrivals, with 36% of NSW humanitarian arrivals from 2010 to 2015 settled in South West Sydney.

There is also significant socioeconomic diversity within the Liverpool region with significant pockets of socioeconomic disadvantage. Another key feature is the ageing of the population, with the number of people aged 65 years and over projected to grow by 129% within the Liverpool LGA (22,800 to 52,100) from 2016 to 2036.

The broad demographic mix provides an ideal environment in which to undertake clinical trials with broad applicability.

The Precinct will be developed with the community around it in mind and will act as a vehicle for local community needs. Education and research will address the unique needs and characteristics of the community.



Lifestyle behaviours of local communities

The lifestyle and behaviors of the community, which are impacted by their socioeconomic status and other demographics can impact on the lifestyles of the community.

Within SWS region, the community experiences increased rates of a range of diseases and issues including chronic disease, cancer, diabetes, mental health and drug and alcohol abuse. These lifestyle and disease profiles contribute to pockets of the region with lower life expectancy and healthy lifestyles.

In order for healthcare delivery to be sustainable into the future, we need to better understand, prevent and treat chronic diseases and reorient our services and continue to meet the needs of the community in regards to health service delivery, research and education.

The broad mix of lifestyles and associated burden of disease provides an ideal environment in which to undertake clinical trials with broad applicability.

The Precinct will be a world leading research hub support the health and research areas that matter to the local community.

The health landscape

Better connecting care for the community

The Precinct will support the vision of a local health neighborhood through the integration of health, research and education to meet community needs

The vision for the Liverpool Innovation Precinct is being developed with the recognition that the healthcare system will need change in some significant ways into the future. As noted in the 2015 Intergenerational Report, Australia's growing population is living longer. The cost of health services is also rising at twice the rate of GDP. An ageing population, sedentary lifestyles and an escalating chronic disease burden is likely to increase the demands on our health system. Australians will also want to benefit from the latest medical advances such as personalised medicine. While the cost of Australia's health system currently represents 9.8 per cent of GDP, real federal health expenditure per person is projected to more than double over the next 40 years unless we think differently about healthcare.

It is the health consumer who has the biggest stake in ensuring the future sustainability of our health system. Putting the consumer at the centre of care models by applying customer-focused models will ensure that Australia more consistently delivers quality outcomes for its people including better patient health outcomes, satisfaction and lower costs. A concerted focus on wellness and prevention (including encouraging changes in individual behaviours) offers exciting potential to reduce mortality rates from heart disease, diabetes, cancer and stroke. Fostering innovation across the healthcare value chain – including greater use of public-private partnerships – will also ensure the system's long-term sustainability.

Key goals of the care agenda going forward (see PwC 2016) that the Liverpool Innovation Precinct will consider are:

- A reorientation of healthcare delivery towards proactive primary and community services, rather than reactive and often preventable hospital care.
- Care focused on the prevention of chronic and long term illness and early intervention to reduced acute demand.
- The empowerment of those who use health services and a relentless focus on patients' experiences and needs.
- Integrated services and systems across public and private providers, including shared patient record and telehealth.
- A reconfigured health workforce that works more as a team around the patient's needs and allows health professionals to work at the top of their profession.

Within the Liverpool region, SWSPHN has developed a local health neighbourhood vision in which services are designed and shared to envelope their users, where data is collected and analysed, and technology patient records facilitate more integrated and continuous care. Part of this vision includes ensuring consumers understand how to access care and are more involved in maintaining and managing their own health. Through working together, the region collectively experiences increased capacity to provide the right quality care in the right place at the right time.






The patient centred medical home is at the heart of an integrated health system that wraps around the patient. In Australia, this medical home is typically a general practice or Aboriginal health service. These services form part of the healthcare neighbourhood. The patient and the medical home remain at the centre of this healthcare neighbourhood. In accordance with the principle of coordinated care, the neighbourhood supports the medical home and remains connected with it (Agency for Clinical Innovation 2017).

The health landscape

Technology as a disruptor and enabler

The Precinct will be a flagship for robotics and automation in health and advanced manufacturing, investing in and attracting industry partnerships to Liverpool to support care delivery, research and education and training.

Digital disruption and emerging technologies requires a rethink of the way education, health services and research is delivered. Technology development in healthcare has been rapidly moving from products to services, and platforms and now into medical solutions such as robotics and artificial intelligence (Frost & Sullivan 2016). There have been trends towards personalized and precision medicine, greater access to information and interoperability of systems.

Last decade	Current decade	Next decade
<p>Medical Products</p> <p>Equipment, Hardware, consumables</p>  <p>Differentiation is solely through product innovation. Focused on historic and evidence based care.</p>	<p>Medical platforms</p> <p>Wearable, Big data, Health Analytics</p>  <p>Differentiation by providing services to key stakeholders. Focused on real time outcome based-care.</p>	<p>Medical Solutions</p> <p>Robotics, AI, Augmented Reality</p>  <p>Differentiation via intelligent solutions for evidence/outcome based health. Focused on preventive care.</p>

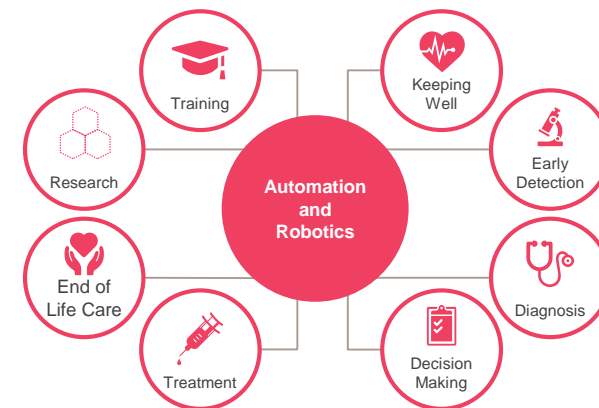
Source: Frost & Sullivan, 'Transforming healthcare through artificial intelligence systems', 2016

Smart robotics and automation holds great value to the world economy with the market expected to grow 10 fold in the next five years with an estimated value of \$6.6 billion (Accenture, 2017). These technologies help to address healthcare needs in an environment of rising health costs, digital expectations from consumers and increasing need and demand for interoperability. Robotics and the more to personalised medicine can enhance efficiency, quality and outcomes for patients and support the integration of health data across platforms. Medical solutions technology has the opportunity to create industries, support world class training and deliver world class care to the community whilst also creating new industries for the local workforce.

The CSIRO has identified the importance of medical solutions technology in the growth of the Australian economy, identifying smart robotics and automation, advanced materials, sensors and data analytics, additive manufacturing and augmented and virtual reality as strategic growth opportunities for Australia's manufacturing sector.

Key enablers for the adoption and use of new technologies include the incorporation of robotics and artificial intelligence expertise into an organisation's structure and governance and build an artificial intelligence smart workforce through training. Liverpool Innovation Precinct partners are already investing in research of, education into and delivering health with robotics and automations for example the Dual Console da Vinci Xi Clinical Robot and Robot Simulation Training Mimic System.

Examples of partnerships between industry and education and healthcare providers in robotics, automation and artificial intelligence.



Google DeepMind is partnering with the University College London's Hospitals' radiotherapy Department. DeepMind will test the use of AI and machine learning to reduce the time it takes to plan radiotherapy treatment for hard to treat cancers of the head and neck.

Pharma.AI is the Pharmaceutical Artificial Intelligence division of Insilico Medicine, a bioinformatics company located at the Emerging Technology Centers at the Johns Hopkins University, launched in March 2016. They focus on drug discovery programmes for cancer, Parkinson's, Alzheimer's, and other ageing and age-related health issues. (PwC, What doctor? Why AI and robotics will define New Health. 2017)

The future of health

Translational research

The Precinct will have a translational research focus delivered in partnership with the community and industry to meet the needs of the population.

Translational research is a key priority to improve the health of populations and is increasingly being recognised globally as its own research field. Translational research applies findings from basic scientific research in a laboratory setting into potential treatments for disease. Bedding translational research within health, creates a culture of quality, underpinned by strong research evidence to deliver the best care to patients and the community. It also ensures research is aligned to the communities needs.

The recent restructure of the NHMRC grant system aligns with the translational research focus, with changes to grants that support partnerships and innovative research projects, with mid to short term timeframes. These grants favour commercialisation and translational medicine ideas with grants specifically aimed at innovative and creative research projects.

Within South Western Sydney, the Ingham institute is focused purely on translational research whilst WSU is establishing a translational research hub.

In setting the agenda of health and research, Professor Anne Kelso AM, Chief Executive Officer, NHMRC identified priorities for research in Australia moving beyond creating new knowledge to the broader role of research in contributing to policy, teaching, leadership in industry and health.

Research has a critical role across a health and education precinct to be embedded across all aspects of training, learning and deliver of care as well as through applying them to industry and the public and private sectors. It is important that research has a strong presence including:

- Research-strong university faculties of medicine, health and science, so that the medical and health professionals and the scientists of the future are educated, trained and inspired by research active and enthusiastic teachers.
- Research strong hospitals and health care providers, so that there is leadership in our teaching hospitals in introducing better research based practices, and acting as exemplars for the whole health care system.
- Research leadership in primary care (medical and allied health) for extended and strengthened evidence based primary care.

Translation research and learning within the Liverpool Innovation Precinct is supported by the South West Sydney Research Hub that brings together healthcare, research and health education entities in South West Sydney as a co-ordinated Hub. The Hub supports the research agenda of the Precinct through:

- Strengthening research capacity and facilitating efficient implementation of health and medical research findings.
- Facilitate collaborative engagement to improve resource access and research literacy.
- Foster areas of emerging research excellence with a focus on community need in line with the current research priorities established through the Ingham Institute.

The development of flagship health and research areas within the Liverpool District, research will further support the development of the collaborations between industry, training organisations and tertiary institution by targeting effort and investment into these areas. Features of this collaboration will include:

- Further building partnerships with industry and commercial partners in delivering teaching: This will support innovative and creative thinking, builds networks and provides a basis for idea generation and entrepreneurship by introducing state of the art concepts earlier than would otherwise be available. This will be supported through the Liverpool innovation hub.
- Research integrated learning – that provides students with the opportunity to conduct, critique, and engage in research integrated learning practices promoting critical thinking and helps to support life-long learning.

The vision for Health and Industry

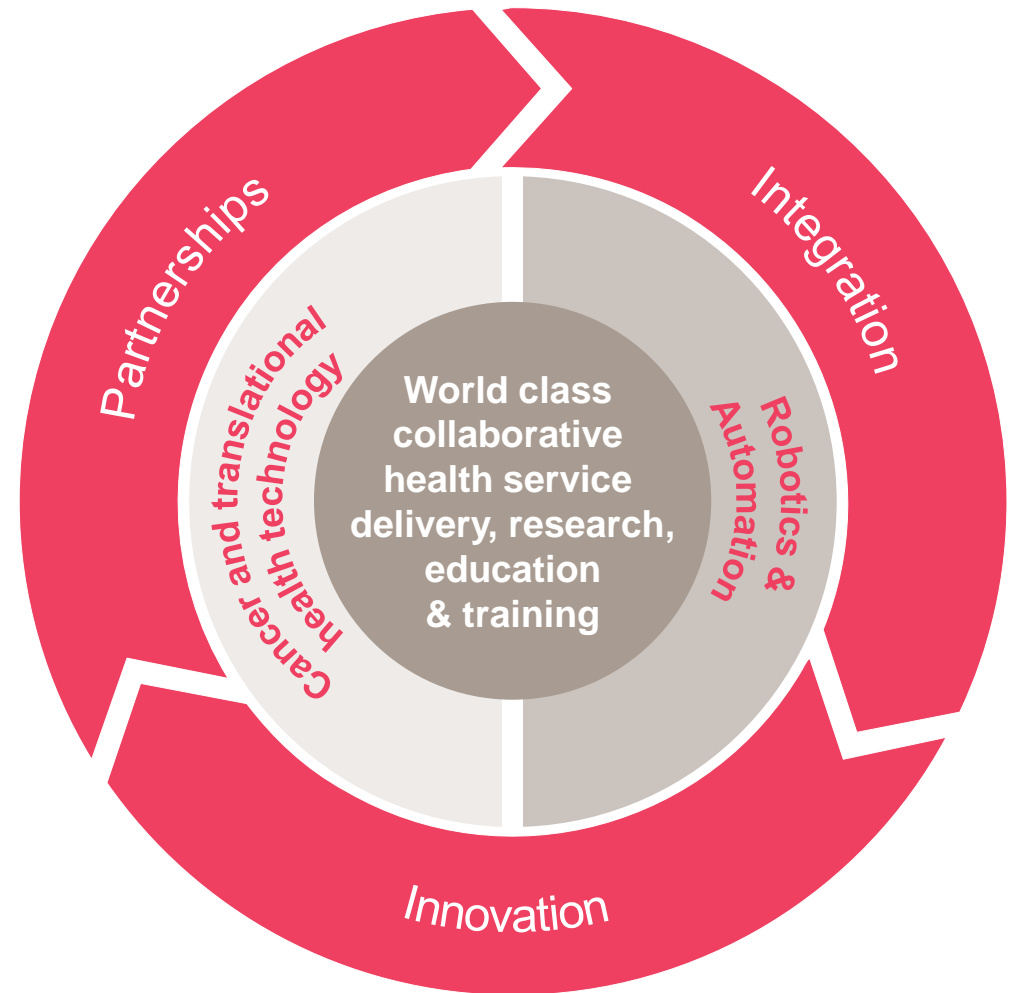
To reimagine world class health, research and education in Liverpool, putting collaboration at the core

Building on current strengths and the needs of the local population, the Liverpool Innovation Precinct will grow its health and research footprint using collaboration and focus areas as two key principles. It will develop Liverpool as a flagship for cancer care and research for those in Western Sydney and beyond, and will partner with industry to research and develop cutting edge medical technologies. This will be driven by strong public-private collaboration across the Precinct, supported and enabled by digital technologies. Core focus within the Precinct will include:

- Strengthening anchor institutions with hospital expansion, growth of universities and the Ingham institute. This includes further enhancement of the Hospital complex through the vital next stage development of the Public Hospital and a unique approach to co-delivery of services with private health providers. This development will allow continued access to world class health services for a population that is growing at twice the rate of the NSW average.
- Establishment of Liverpool Innovation Precinct as a Centre of Excellence for Cancer and Translational Health Technology for South Western Sydney and beyond. This strategy builds on current strengths and addresses the growing demand for cancer services and opportunities for access to diverse and large patient cohorts for translational research.
- Development of an advanced manufacturing, automation and logistics hub for the manufacturing of components for medical devices, health related technology and prosthetics, leveraging Liverpool's manufacturing workforce profile, research and transport links.

Key investments and enablers within the precinct that will support the vision include:

- Developing **partnerships** with industry, not for profits and the private sector to support the vision and health delivery including the potential for a co-located private hospital
- Integration of information and space with **shared digital infrastructure** to support clinical trials and a preventative health neighborhood approach to meet communities health needs
- Establishing a **startup hub** to incubate new ideas across the spectrum of health, research and education in collaboration with the community and industry.



Expansion of world class, collaborative and innovative health services in Liverpool through public private partnerships

Objective

The Precinct's health providers should strive to:



- Deliver world class health services against increasing healthcare demands in Liverpool and surrounds to become a driver for change across South Western Sydney and NSW
- Strengthen the anchor institutions of the hospital and universities through service expansion
- Health delivered in integrated spaces, governance of research, clinical trials ease of, access to linked clinical data, engagement with the community
- Engagement with partners outside and within the Precinct in the expansion of capacity and service delivery

Expansion of the public hospital service

Currently in the planning phase, the Liverpool Hospital Stage 2 redevelopment builds on the enhanced acute capacity completed in 2012. The next stage of the Liverpool Hospital Redevelopment is proposed to include:

- Cancer Centre (Inpatient beds, Ambulatory Care Bays, Day therapy, Ambulatory, Haematology, Ambulatory Cancer rehab, Breast diagnostics and assessment, palliative care inpatient unit, medical and radiation haematology inpatient units, areas for clinical trials).
- Clinical Services (Critical Care, Maternity and Paediatrics – Neonatal Intensive Care Unit and Special Care Nursery).
- Associated support services (Pathology, Docks).
- Mental Health, Aged Care and Rehabilitation expansion.
- Ambulatory Care, outpatient clinic and day procedure.
- Facilities and capacity for further teaching and research associated with Ingham Institute and University Partners
- Fit for purpose and scale emergency department

Opportunities exist for some of this infrastructure to be delivered in collaboration with private partners.

There is an opportunity for the establishment of a new private hospital co-located with the current Liverpool Hospital.

Sydney Southwest is an 87 patient-bed facility run by HealthScope located on Bigge St near Liverpool Hospital. The hospital is invested in the area and runs five operating theatres, Angiography suite, 10 bed Intensive Care Unit, Maternity Unit, Special Care Nursery as well as a Day Surgery Unit, Mental Health Unit, Oncology Department with a chemotherapy day centre as well as pharmacy and radiology services. The true value of a private hospital within the region has not been realised. Whilst located on Bigge Street, Sydney SouthWest is close to the Ingham Institute and Liverpool Hospital campus however the service is not integrated with the campus meaning that the benefits of co-location are not being realised.

For all partnership opportunities, co-location is a critical factor to success. Proximity of the services ensures close integration, enables the sharing of infrastructure and resources, incentivises clinicians and enables patient transfer between services which is particularly critical for a private hospital partnership. The co-location also provides potential for other areas of the Precinct to engage in translational research. When approached with the right engagement strategy, planning and governance, private public partnerships are highly attractive and mutually beneficial to the community and the providers (Clayton Utz, 2013).

To date, barriers from the market to establishing a private hospital co-located with Liverpool have included uncertainty around scope of services, competition and the availability of private patients within the region. The expansion of the Liverpool Innovation Precinct with new industries, population growth and an increase in skilled workforce, will create an environment in which there are mutually beneficial opportunities for the provider, hospital, education precinct and the broader community. Through the Precinct vision with collaboration at the core, there will also be a greater willingness to engage with and co-design future service integration opportunities with the private sector.

Unlocking the value of a dual hospital Precinct

Liverpool has the potential to realise a number of significant benefits to health, education and research in the Precinct through the co-location of a private Hospital next to the current Liverpool Hospital. These include:

Attracting and retaining talent: A co-located private hospital has the ability to attract and retain respected medical specialists to the Liverpool Hospital campus on a full time basis. Retaining senior staff has the additional benefits of increasing viability of teaching services.

Sharing of care: The private hospital can share a number of specific clinical staff such as senior clinicians.

Reduced operating costs for key clinical services: The private hospital can work with the public hospital to share resources to avoid duplication and maximise benefits for both parties.

Reduce reliance on outpatient workload: Through purpose designed private consulting rooms for onsite medical specialists.

Attracting the market



Key elements of a partnership that will attract the market, where to date has not been interested include:

- shared infrastructure
- transparent procurement and contracting processes
- long term contracts with measurable objectives and metrics
- non compete agreements
- demand management plans – ensure the right incentives exist and allow flexibility of service
- two way agreement with discrete delivery of specialised services

– Roehricha J et al. 2014



Proactive planning prior to a market approach is critical to success

The planning and market sounding phase will be critical to success, and would require initial sounding discussions with Chief Executive Officers of major for profit and not for profit private hospital operators to determine the most attractive components to include in a formal Expression of Interest. When collaborating, it is critical to develop open and transparent, direct relationships with providers to build trust and accountability. An effective market sounding exercise provides an opportunity for a structured dialogue between the private and the public sectors at early stages of the partnership process.

The first key step is to undertake one on one discussion with market players. Key elements of the partnership to be discussed include:

- Many private and not for profit providers deliver care across the care continuum from preventative to primary and acute care – how will the partnership help Liverpool to achieve its strategic goals and meet the needs of the community?
- Understanding the collaborations and arrangements that providers have with Research Institutes – do these align with the Precinct vision and can they be leveraged?
- Discussing digital system interoperability – IT system interoperability will significantly enhance integration of clinical and non-clinical services between the public and private services.
- Following conversations, an Information Memorandum will be developed and distributed to targeted providers which details the opportunities for contracting and sharing resources.

Establish a Centre of Excellence and Research in Cancer for South Western Sydney

Objective

While leveraging the existing leading expertise within the Precinct partners, Liverpool Innovation Precinct should be recognised as an International Centre of Excellence in cancer research, prevention, care and training and a Centre of Excellence for Translational Health Technology. This includes:

- Innovative models of care.
- World renowned translational research.
- Partnerships and collaborative arrangements across all Liverpool Precinct partners including sharing of data, facilitating education and career pathways and joint collaboration on research.



Opportunity

The health, education and research partners of the Liverpool Innovation Precinct are leaders in cancer care, research and training in a number of areas. There is an opportunity to build on these strengths to develop an internationally renowned clinical focus on cancer across health, research, education and training.

The Liverpool Innovation Precinct could establish cancer as their flagship clinical focus area, becoming a Centre of Excellence across cancer detection, diagnosis, treatment and management as well as consumer engagement around disease prevention. This would span across health, research and education and training, and would build on the current strengths of SWSLHD's comprehensive cancer services including their comprehensive imaging services and the extensive cancer research undertaken through the IIAMR. The choice of cancer as a clinical focus is reflective of the demand for cancer services locally. The Ingham Institute is the management centre for a consortium of over 200 cancer professionals who represent multi institutional stakeholders across South Western Sydney and beyond. The large geographic and demographic footprint serves a population of over 1 million, with more than 5,500 new cancer cases per year and a projected 63% increase in the prevalence of cancer in the SWSLHD catchment between 2007 and 2021. The unique and diverse population of South West Sydney also presents opportunities for access to diverse and large patient cohorts for translational research.

The NSW State Infrastructure Strategy 2012-2033 (SIS) outlines the benefits of specialisation as having greater capacity to attract a critical mass of specialist clinicians, facilitate high standards of education and training and invest in advanced specialty equipment. Through the Centre of Clinical Excellence, there is an opportunity for the Precinct to differentiate themselves and achieve national and international eminence in cancer care, translational research and education and training.

Future of cancer research

The cancer research landscape is constantly moving forward, the American Association for Cancer Research (2017) has identified current trends in cancer research as:

- Precision medicine with the personalised treatment with vaccines, molecular targeted therapies, neoantigens and use of biomarkers in patient selection.
- Cancer genomic medicine and the importance of data sharing.
- Immunotherapy, biomarkers of immunotherapy response, therapeutics target immune checkpoints.
- Cancer prevention.

Examples of best practice cancer health and research within the precinct

The precinct partners are delivering national and world leading research and care aligned with the future of cancer research which will be built on within the precinct. Examples include:

- The state of the art MRI Linac cancer therapy equipment pioneered in Australia at the Ingham Institute and located within the Research Bunker of the Institute's research precinct at Liverpool Hospital. This is the only MRI Linac research facility in Australia and one of four in the world.
- Liverpool Cancer Therapy Centre is leading the way with a number of trials including the trial of radiation therapy for prostate cancer using targeted stereotactic radiation therapy using pin point precision technology.
- Ingham Institute cancer researchers hosts Australia's first Circulating Tumour Cells (CTC) assay machine. This enables cancer cell genetic make-up to be studied to determine why and how certain cancers spread to develop a targeted and personalised treatment for each individual patient.
- The Translational Cancer Research Unit at the Ingham works across various disciplines of cancer research to improve clinical outcomes for patients by decreasing the incidence of cancer, increasing patient survival rates and improving quality of life.

Liverpool as a health robotics and automation hub

Objective



- Leveraging university and TAFE partnerships, the precinct will become a hub focused on the development of smart robotics and automation to support the spectrum of health and wellness for the Liverpool community and beyond.
- Delivery and development of technology to further fund learning, research and health service delivery.
- In line with the cancer flagship, the hub could have an initial focus on cancer – diagnostics, prevention, treatment and products.
- As part of the flagship, the manufacturing strength of the region will be leveraged to look at Liverpool being a health logistics hub.

The Liverpool Innovation Precinct has an opportunity to become a hub for the development of health related technology such as robotics and advanced materials such as medical devices, prosthetics and pharmaceuticals. This growing industry would support the health, research and education & training needs of the community and attract other organisations into the region.

The region is well placed to develop their robotics and automation flagship to due to their access to:

- technology through University and industry partnerships
- development funds with University and industry joint projects
- the population to trial developments.
- skilled local labour markets manufacturing health
- proximity to WSA as well as the road and rail network including Moorebank intermodal freight precinct.

There is significant opportunity to combine this key industry and the growth industries of health and education to develop health logistics and advanced health manufacturing profile within the flagship areas of cancer and robotics and automation.

Health robotics and automation

Liverpool Hospital is a national leading public hospital in regards to robotics with the acquisition of a Dual Console da Vinci Xi Clinical Robot and Robot Simulation Training Mimic System. Investment in technologies such as these robots allow opportunities for world class training for students and translation research opportunities. In regards to the manufacture and distribution of health products, Liverpool is already starting to play in this space with the manufacture of radiopharmaceutical products created by the GMP compliant cyclotron onsite at Liverpool Hospital.

With a continued and enhanced focus on precision medicine, the Liverpool Innovation Precinct will attract technology start-ups and enterprises to work and invest in the area enabling patients to receive world class care, clinicians and students access to world class technologies. Opportunities should be explored to develop partnerships with companies who manufacture medical supplies and products including advanced manufacturing/robotics, circuitry and control devices. This would build on existing partnerships and investment in the region such as UOW's long-term agreement between Liverpool-based multinational manufacturing company Daikin Australia and the presence of a number of health manufacturers in the Prestons region. Through the innovation hub these partnerships can be developed identifying research opportunities, product development and education pathways and programmes.

Liverpool as a health robotics and automation hub

The precinct could further support this flagship through tailoring subjects and courses with relevant skills through the TAFE skills exchange model and university degrees and short courses. Relevant skills include electronics, computer science, biotechnology, manufacturing and cognitive science. As it relates to healthcare a theme that could be explored is how clinical coding and recording could be further automated into the future with different skills built into courses. The Precinct will provide opportunities for the students to have industry experience. The startup hub will support industry partners to invest in the area and incubate ideas with access to data, technologies and people to support their company goals.

Start ups transforming healthcare with AI



There are a variety of established and emerging companies in this space that the Precinct could attract to collaborate with and invest. Examples include:

- Large medical device and technology companies.
- Health logistics and supply chain companies and organisations.
- Start up businesses transforming healthcare with artificial intelligence. (see across)

Enablers – Integration and connectivity of information and innovation lifecycle

Objective

The Precinct should aim to be:

An integrated network across the health service delivery, research, education and training, enabled by digital technologies



Technology is a key enabler within successful health cities and Precincts with interoperability across universities and TAFE NSW, Research Institutes and Hospitals (both private and public) an important enabler. Interoperability allows for the sharing of data which is critical for collaborations of this nature.

The Precinct will have:

- shared digital infrastructure across the campus to create one consistent experience for patients, researchers, students and clinicians across the Precinct.
- technology platforms allowing information sharing to support translational research and education.
- common use interface and information sharing across the hospital facilities and primary and community care to enable ease of patient transfer and clinician experience.
- consumer facing applications for navigation around the Precinct and provide a channel for Precinct partners to communicate with consumers, residents and the workforce.
- strong governance and information sharing agreements and process across the Precinct partners.

Key considerations: Strong digital technologies and platforms would promote innovation and encourage technology companies to utilise the Precinct as a pilot site for new digital health technologies. Opportunities should be explored to identify information technology support services companies who could invest and partner to support the technology to integrate the partners of the Precinct and create an innovative, supportive user experience.

Objective

The Precinct should aim to:

Enable innovation through research and development across the whole innovation lifecycle



Liverpool aims to be a place where talented individuals are attracted and stay for their whole career. This means that Liverpool needs to plan for individuals and the ideas they develop to grow within the Precinct at all stages within the innovation lifecycle.

The Precinct will aim to have:

- university-led start up spaces including incubators.
- access to quality technical facilities to progress development beyond incubation and acceleration.
- an industry anchor with an innovation focus. The presence of an industry anchor will attract further industry to Liverpool which will build momentum and resiliency for the development of a robust innovation presence.
- effective collaboration and strong partnerships across the whole of the innovation lifecycle between industry, research, health and education.

Key considerations: Planned intention and investment will be required for the creation of a successful innovation precinct. The creation of shared facilities, which will enhance collaboration facilities will need to be owned and run by the principal stakeholder. There is currently limited funding availability for commercialisation of research particularly for Early Career Researchers. Liverpool would be well placed to support changes NHMRC research funding to have an increased research commercialisation and development focus.

20

Education vision

The education challenge

At a broad level, the model of education evident in Australia is seen as having series of potential limitations on innovation and quality educational outcomes, including:

- educational institutions that actively compete with each other in the same market, all doing similar things (or everything)
- a supply driven emphasis on funding levels and the popularity of courses rather than world class outcomes
- little or no connection or handover between phases of education
- a lack of progression pathways between qualifications and institutions
- a lack of progression pathways from qualification to qualification
- an opaqueness that often makes it difficult for industry to see how they will have a skilled, relevant workforce
- curriculum driven by institutions rather than industry demands creating a disconnect between what is it taught in institutions and what is required in industry
- a subject based approach rather than an integrated learning approach.

These limitations have been brought to the fore by a series of ongoing range of disrupting factors, including:

- global competition – students are increasingly mobile (inbound and outbound) and hence traditional catchment zones are being undermined,
- technology (in jobs) is putting new demands on graduates,
- student expectations – with choice, students are placing increased expectations on institutions from a quality and relevance perspective,
- jobs of the future – automation, the frequency and speed of change (see figure) mean that learning needs to be more flexible and responsive to changed market dynamics,
- ‘edtech’ – new technology enabled delivery methods are challenging the conception of a traditional campus; and
- declining public funding for vocational and tertiary institutions – forcing these institutions to look for new revenue sources.

To be distinctive and maximise the potential of the Precinct the education providers should explicitly be seen to addressing these issues (even if they are not existing issues in Liverpool).

It is predicted that today's school leaver will have 17 jobs across 5 careers in their lifetime

17 Jobs



5 careers



<http://saf.org.au/perceptionsarentreality/>

The opportunity available to Liverpool

Liverpool provides the opportunity to leapfrog the challenges and disruptions, highlighted previously, to become a world-class education precinct that caters for the future needs of students, researchers, industry partners and the broader Liverpool community.

This can be done by recasting the Liverpool city centre into an expanded cross-institutional virtual campus that, over time, has the potential to become a new standard in education models and deliver welfare enhancing collaboration between education, research, industry and government (Etzkowitz 2003).

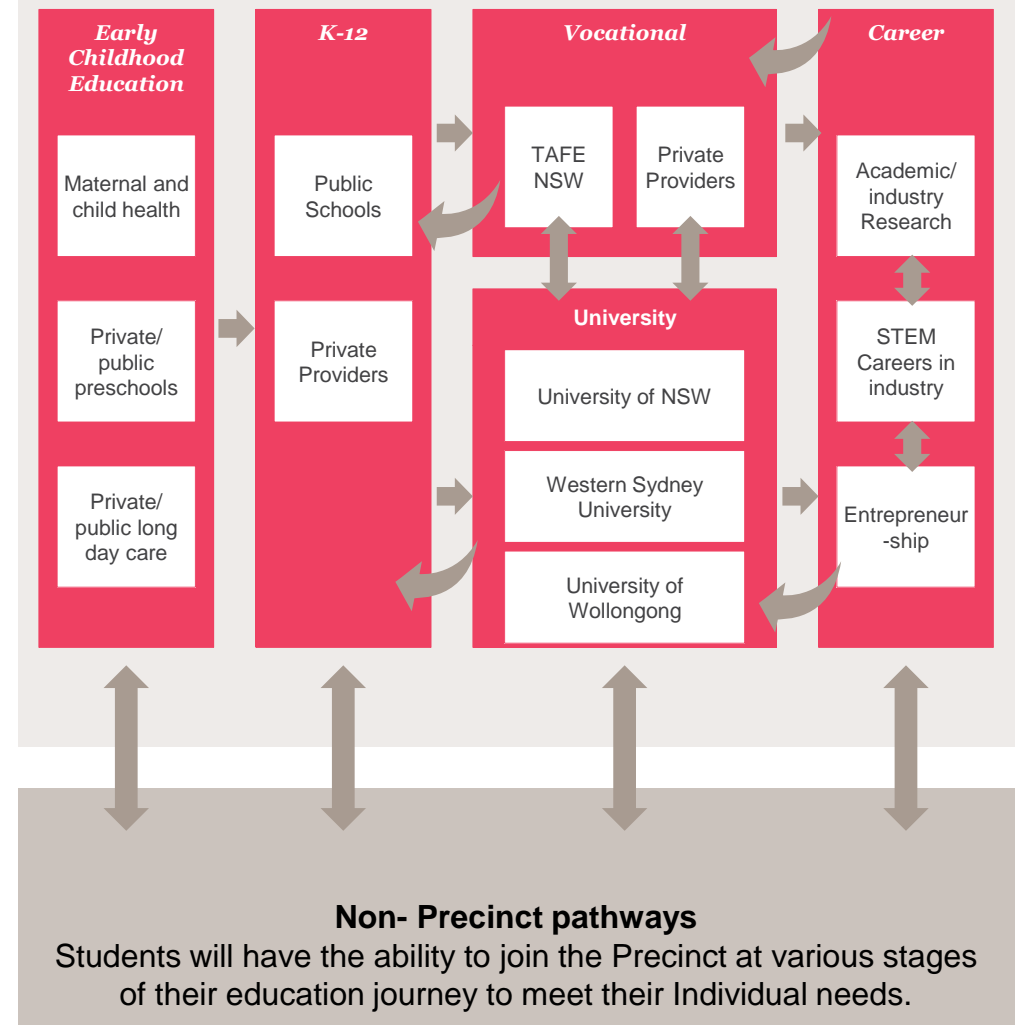
At this stage the Precinct includes the following education providers across all stages of a student's educational journey: three universities (WSU, UNSW and UOW); one research institute (Ingham Institute); one TAFE NSW campus; five schools (Liverpool Public School, All Saints Catholic College, All Saints Catholic Girls College, All Saints Catholic Primary School Liverpool Girls' High School and Liverpool Boys High School); and several early learning facilities.

The co-location of these institutions is beneficial to students and educators, creating an environment that can improve school and student performance (Chapman & Muijs 2014) and the opportunity for educators and researchers to transfer knowledge and develop new skills (Munson 2013).

The Precinct will enable the creation of partnerships between education providers/institutions and global and domestic industries. These partnerships are important to drive innovations in R&D which benefits the participating industries through the discoveries of new products and/or services.

The education journey fostered by the Precinct will be based around collaboration and integration. This means that the journey will facilitate 'cross-fertilisation' with institutions and persons outside of the Precinct at all stages of the education process. For example, there will be multiple entry and exit points in the lifecycle to enable students to better manage their lifelong education.

The Precinct's Education Continuum



The role of the education providers

Education for the 21st century

The education system must respond to changes in the labour market

Develop towards a learning economy

Do not only learn knowledge and skills, but also fully exploit them

Life-long learning.
More flexibility in education possibilities via technological developments.

Short employment contracts and more entrepreneurship

Focus on employees in all life phases

Prepare people for flexible careers

The pursuit of education and knowledge is a lifelong journey.

Early childhood education (0-5 years)

Early childhood education and maternal and child health are critical in providing a strong basis for future education pathways (PwC 2014; OECD 2011) as well as offering the service provision required for the mix of families living and working in the Precinct and Liverpool more generally.

As such, the Precinct will provide a range of early childhood services (e.g. maternal and child health services, preschool options and long day care options) that will cater to the needs for the families of researchers, educators, students and employees and the broader Liverpool community.

The objective should be to facilitate partnerships between Precinct organisations to create a curriculum that is research informed and adaptive to changing global demands. In particular, the emphasis should be on providing introductions to STEM skills that help to create a strong grounding for future education outcomes (Education Council 2015).

The aim is to create a holistic environment that is attractive so as to attract key talent to the Precinct.

The role of the education providers

K-12 (primary and secondary education)

The existing schools in the Liverpool Innovation Precinct need to be fully integrated into the city to benefit from the Precinct's facilities.

Alongside normal teaching expectations, the goal should be to emphasise research and industry-specific fields that are prominent within the Precinct and the Liverpool LGA.

This can be done by collaborating with leading organisations in the Precinct and the LGA. That is, organisations should be encouraged to support the creation of additional educational offerings (eg courses and extra-curricular activities) that:

- are tailored towards future job prospects in Liverpool and the broader region.
- disseminate output generated by health, education, research and industry institutions in the Precinct.

There will also be the opportunity for the provision of extension studies for high performing students to enable transition into higher education.

The Precinct Advisory Committee (and its workstreams) will look to facilitate engagement and interaction between the parties to co-create and offer educational programmes that foster innovation and develop long term opportunities for students.

Consideration should be given to encourage the next P-TECH (Pathways in Technology) school in Liverpool (see Box), either in an existing school or as part of a new school. As a differentiator to existing P-Tech schools, health use of information technology (eg clinical coding) could be developed as an area of specialisation.

P-TECH is an innovative model of education-industry collaboration, providing students studying for their High School Certificate (HSC) with an industry supported pathway to a STEM related diploma, advanced diploma or associate degree. The P-TECH model encompasses the following elements:

- **targeted curricula** - engaging industry with curriculum development can identify key skills and training requirements that are necessary for long term job prospects to support and progress the existing Australian Curriculum to achieve the best employment outcomes for students.
- **innovative approaches to learning** - partnerships between schools and industry enable innovative approaches to the way learning is delivered; approaches that would not be possible if schools, or industry, acted in isolation. Working together, schools and industry can provide opportunities for students to engage with the world of work and better understand the relevance of their learning to jobs and how they may develop their careers.
- **industry mentoring and support** - the mentor relationship between young people and industry personnel provides continuity of support for students to achieve a post-school qualification. The mentor relationship ensures the students' learning stays on track and provides opportunities for guidance to help young people make informed decisions regarding their education, training and employment options.
- **a post-school qualification**- schools will partner with other education providers (TAFEs/RTOs or universities) to deliver elements of the P-TECH learning (either on-site or off-site) and achieve a diploma, advanced diploma, associate degree or undergraduate. A strong relationship between the school, industry and post-school institution(s) should provide a seamless pathway and continuity of support for students as they transition from school to further education to complete their post-school qualification.
- **links to employers** - collaboration between the education and industry sectors strengthens the connection between student learning and the skills that employers are looking for. Employers will also be able to directly influence their pipeline of future talent when they take part in this collaborative practice.

The role of the education providers

Vocational

A balanced and effective workforce requires comprehensive vocational education options. The revitalised Liverpool city centre will allow greater collaboration between industry and vocational providers to ensure that students are developing the appropriate critical skills for the jobs market.

Particular emphasis will be to engage with local employers to understand their workforce needs to enable the development of clear career pathways and the relevant technical skills that have both short and long-term job prospects. A structured approach to vocational training will upskill talent to enable Liverpool to take advantage of upcoming opportunities, including the WSA.

The closely aligned relationship between technical education and industry supports innovation in education to:

- increase parallels between learning and the job market – harnessing the collaborations and partnerships with higher education, research and industry will allow the creation of educational offerings that are tailored towards future job prospects and disseminates the world-class knowledge output generated in the Precinct. This can be achieved through the creation of advanced vocational training programmes and mixed study programmes that allow students the opportunity to study for a higher education degree whilst completing vocational training.
- form collaborative projects with industry partners – creating engagement between the industry partners and Precinct organisations (and the broader Liverpool region) will promote clear pathways and opportunities for students, appealing to a wide audience and developing practical skills required for long term economic success.



The role of the education providers

University

Universities are fundamental to education and research and development. The close relationship between higher education institutions and research facilitates knowledge creation and dissemination that has the potential to deliver substantial personal and community-wide social and economic benefits.

There will be a continued emphasis, throughout the Precinct, on delivering a flexible and adaptive approach to learning with a focus on STEM subjects as the cornerstone of university-delivered health and research opportunities. This will provide choice for students to identify the appropriate learning pathways, facilitated by tailored education offerings across the Precinct's universities.

In this regard the Precinct will aim to encourage universities to work together to:

- deliver a multidisciplinary approach – engaging with institutions that have the desire for a truly collaborative and inclusive approach to teaching will prepare students to work collaboratively across disciplines to look for innovative methods to tackle the future challenges.
- utilise digitally enabled facilities to offer new and varied offerings – the university investment in the Precinct should enable them to develop innovative and inclusive teaching options that expand the reach and output of individual institutions' physical campuses. The goal here is to encourage new investments by the three universities to consider how they can share infrastructure, avoid wasteful duplication of investment and provide world class facilities.
- harness research outputs and industry partnerships– the concentration of activity and the building of closer relationships between universities and industry will allow co-creation educational offerings designed to prepare students for future careers.

Such collaboration is not unprecedented, with the University of Newcastle (UON), UNSW Sydney and UOW having recently announced that, while retaining their legislated independence and ongoing autonomy, the universities will work together to initiate new, and intensify existing teaching and research collaborations (UNSW Media 2017). They note that:

Similar alliances internationally have delivered significant value for their communities through independent, research-intensive universities that are co-located in a geographic region, leveraging complementary strengths for public benefit.

The Liverpool Innovation Precinct should be encouraging similar collaborative commitments from all universities in the Precinct. This will be challenging due to the competitive history of the universities in Western Sydney, and so should be a priority of the Precinct Advisory Group (and its associated workstreams). This may require external guidance to identify opportunities for collaboration.

Seamless transitions and pathways



A key component of the integrated education model in the Precinct is the commitment to seamless transitions and pathways between the Precinct's education institutions.

That is, education providers will be encouraged to offer:

- flexible entry options through recognition of prior learning (RPL)
- the flexibility for students to enter and exit institutions from different paths
- the tailoring of the education requirements to an individual student's need.

This will allow students to move vertically through the traditional education model but also enable pathways between education providers, industry and enterprise, supporting continued development and supporting long term innovation.

Education pathways

Students within the Precinct will have the opportunity to earn all qualification types across the student lifecycle. Education providers should be encouraged to allow students to self-direct their learning, providing the flexibility to identify the right education pathway for their own future.

In this way, the students in the Precinct should be provided with opportunities that would otherwise be unavailable (or hard to obtain), such as:

- multi-institutional teaching and learning
- internships
- research-focused education.

As such, the Precinct will facilitate relationships that both improve overall student outcomes and narrow the gap between the lowest and highest student performers.

This will be enabled through:

- co-location of early childhood education, elementary & secondary schools, vocational education and higher education in the Precinct, allowing for close relationships and identification of solutions to help individual learners reach their potential
- supporting partnering, active involvement and participation of industry to provide alternate learning experiences (eg work-experience, industry led-education and collaborative projects) that allow students early opportunities to engage with organisations that help to foster strong relationships for future careers
- facilitation of the co-ordination of RPL policies across Precinct-based organisations. This will enable student movement between degrees and courses, multi-institutional learning and potentially co-badged and/or joint qualifications.

The concentration of activity in the Precinct, undertaken in a collaborative manner, will:

- support seamless transitions between each stage in a student's education journey.
- provide students with the opportunity to learn from different education and research institutions within the Precinct.

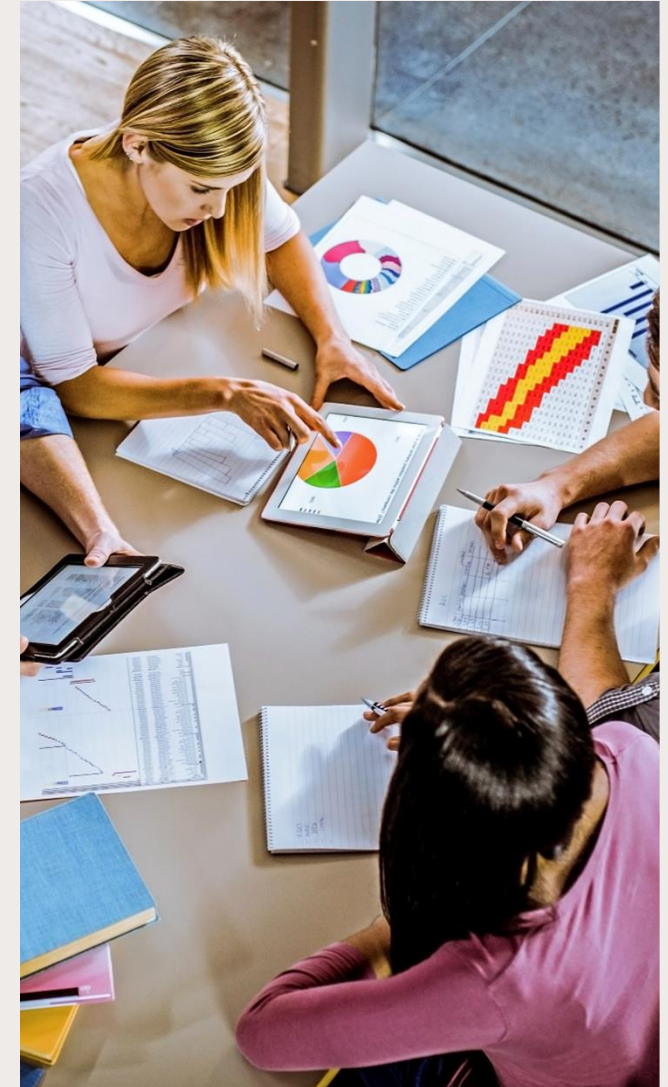
Seamless transitions and pathways

Career pathways

An explicit aim of the Precinct should be to provide multiple career pathways for students and graduates. This will require close collaboration between industry and education partners.

Creating an environment that supports greater collaboration has the potential for industry to be involved throughout the education journey. This can facilitate:

- industry sponsored courses – industry-led content allows students to undertake courses that are recognised as providing a basis for a career in a specific industry and so helps them develop relationships with industry. It also potentially benefits educational institutions by providing financial support and access to facilities and equipment,
- co-developed courses at secondary and higher education institutions – co-development of courses (such as P-TECH programmes) will provide students with opportunities to undertake programmes that can provide post-school certification, with a better understanding of business needs to support a career in the field,
- work-integrated learning – programmes of activity that integrate learning in the workplace prepare students for active participation in the workforce,
- internships and work experience programmes – these will improve a student's prospects of employment by exposing them to different work environments,
- mentoring schemes – creating one-on-one or group mentoring relationships provides students with development opportunities, helps learning, and helps young people make informed decisions regarding their education, training and employment options; and
- industry/research led teaching – involving industrial or commercial partners and researchers in the delivery of teaching helps students to develop alternate methods of thinking. This supports innovative and creative thinking, builds networks and provides a basis for idea generation and entrepreneurship by introducing state of the art concepts earlier than would otherwise be available.




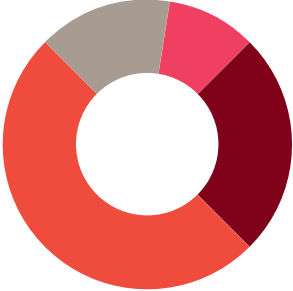
2D

Place vision

Who are the people of Liverpool now and into the future?

Understanding what drives your target user is the key to making great places

Thinking about a precinct from the user's point of view is useful when trying to understand what to focus on. A city can be many things, what is most important is that the city you build both markets itself and authentically delivers on the opportunities that attract the people you want to live and work there. In a health, research and education precinct the main user groups would be students, academics and health service professionals ranging from technologists to surgeons. Below is a snapshot of the broad demographics for the groups of people and the drivers to attract and retain them to the Precinct.

2036 – Population



- Infants
- Student
- Worker
- Retired

Student

Currently half the Liverpool population is under 30 and through population growth, there will be more young people moving through the education system. With the presence of three universities and a TAFE, Liverpool will have see a significant growth in its higher and vocational education student population.

+ How do you attract and retain more?

- Night time economy – for lifestyle and opportunities for part-time employment
- Night time safety
- Walkability and accessibility
- Quality and value-for-money education
- Low rent
- Connectivity

2036 – Household structures


- Families w/kids
- Families w/out kids
- Other

Health worker with a family

Families within the Liverpool area are culturally diverse. A higher proportion of families with children live in Liverpool (75%) compared to Sydney (61%). Liverpool is an affordable and community focussed area.

+ How do you attract and retain more?

- Affordable and diverse housing options
- Good schools
- Career opportunities
- Places where community and family can come together inc. parks and centres
- Night time safety & food options for shift workers



Research scientist Single or Double Income No Kids (S/D-INK)

Liverpool aims to attract and retain highly skilled health workers and researchers. Early career post-doctoral researchers are the most internationally mobile skilled migrants. 37% of households in Liverpool are Single or Double Income No Kids.

+ How do you attract and retain more?

- Career and research opportunities
- Connectivity
- Night time economy
- Cultural activities – Museum, art galleries and maker spaces

College Towns and Urban Health and Research Campuses

Learnings from the case studies

College towns are vibrant, thriving and diverse communities that revolve around one or several higher education anchor institutions. College Towns are also great places for entrepreneurs, a breeding ground for culture and offer amenity for their residents (Liveability 2016). They attract industry drawn to the research collaboration potential and where co-located with health can facilitate a focus on wellness that lifts the quality of life for all ages.



How do you know when you are in a college town and what makes them great? There are some distinct features of college towns:

- The age of the people, with a youth dominated demographic, their college occupation is emphasised by the way they dress.
- The kind of transport modes and the number of people on the street during the daytime.
- A culturally diverse crowd often due to the number of international students.
- The vibrancy of the night life and diversity of small shops and cafes.

It is important to ensure:

- The presence of industry anchors to create pathways from college to employment.
- That whole of life amenity is considered to ensure people come for college and stay forever.
- Lifelong learning opportunities are offered to third lifetimers returning to education in retirement.
- Facilities are made available for conferences, seminars, and events to build profile and attract talent.

What makes a great health and research focused ‘college’ town

Urban planning framework: Nine principles

Analysis of precincts that attract talent, foster connection and collaboration, show nine key features of success (over and above employment/career opportunities). These are based on consistent analysis of both international and national health and education and innovation precincts.

Focal point

Create an identifiable urban centre to define the district. Create places where people will be drawn to and meet.

- Identifiable central hub
- Open access, shared ownership

Catalysers

Ensure the presence of incidental locations to stop and have casual interactions.

- Parks, Street Furniture, Sidewalk stops
- Cafes, Bars, Restaurants
- Inside and outside anchor institutions

Activation

Night and day activation as well as throughout the year.

- Night and Day and over time
- Adaptable Reuse
- ‘Open house’ policy for anchor institutions

Permeability

Walkability and visibility through connections enhance both well-being and potential interaction opportunities.

- Short links & through ways
- Numerous intersections & route options
- Permeability through anchor institutions

Transport options and intermodality

Multiple transport options allow more people to access more of the site and enables economic and social inclusion.

- Multiple options and not single source
- Within 800m of major destination

Urban fabric

The physical treatment of the streetscapes, arcades and buildings with consistency and contrast of materiality, furniture, street trees, lighting.

- Activated street frontages and ground floor retail
- Density and diversity of building types

Reach and limits

Keep the precinct close to maximise the agglomeration potential of clustering and minimise the action-cost of face to face interactions.

- 1600m radius for knowledge transfer
- 800m radius for walkability

Mix of uses

Services and lifestyle amenities should be present to provide relief from pressures and opportunities to engage with community.

- Diversity of people and perspectives
- Live, work and play

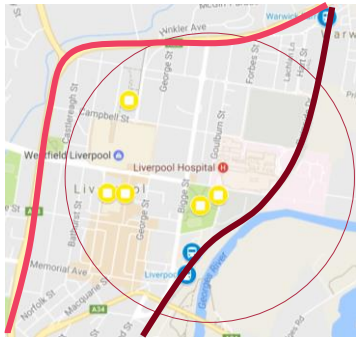
Housing diversity

Housing designed for the different types of people and their varying lifestyles, reflecting scales of aspiration and income level.

- Housing across the spectrum
- Range of types and styles

Liverpool's Place Potential

Positive aspects of Liverpool's urban centre and issues to overcome



Urban principle

Liverpool Now

Reach and Limits



The Precinct is contained within a high walkability radius and already achieves a walk score of 77 (Walkscore 2017). A score above 80 indicates high walkability. The distance between Civic Place to Liverpool Hospital at the Bigge Park entrance is only 800m.

Additionally the city centre (CBD) has well defined limits with clear boundaries: the train line and Georges River on the east and the Hume highway on the north and west. While these help to define the centre they also limit the expansion potential of the CBD and make links across to neighbouring areas difficult. Consideration should be given to ways of bridging these boundaries.



Train Bus Bicycle Walk

Transport Options



Liverpool has high train connectivity with two stations in close proximity which are the Warwick Farm and Liverpool stations. Significant benefit and economic uplift can be expected from further fast connections to the Sydney CBD and new WSA.

The area is also serviced by several bus operators with planned increases to services. Additionally the area around Liverpool is reasonably flat and well suited to soft transport modes of bicycling and walking.

Despite that however only 2.3% of the population walk and cycle, 10% travel by train and a majority (64%) travel by car, compared to cities like Barcelona and Copenhagen where over 45% of people travel by soft transport – walk and bike – and over 20% on public transport (European Commission 2013). The towns ranked the best 'college towns' in the US are the ones with the highest walkability and cycle-ability. Easy intermodal transport interchange between public and soft transport is an aspiration for Liverpool.

There is significant congestion in the city centre and further efforts to restrict cars and provide attractive alternative connectivity options around the CBD should be considered. The quality of urban fabric along major walking routes is an important component of increasing propensity to walk or catch public transport.

Liverpool's Place Potential

Positive aspects of Liverpool's urban centre and issues to overcome



Urban principle

Urban Fabric



Liverpool Now

The presence of heritage buildings and manicured parks creates a strong urban presence to areas of Liverpool. Community involvement in the activation of urban fabric is also present. The covered walkways and consistent awning styles as well as rows of trees add to the quality of the urban fabric as does the use of pavings and earthen blocks for walkways and walls.

Some good examples of areas with these features are the mall and further up Macquarie Street where these areas invite people to walk and congregate. However the area around the station, connections between the hospital and Macquarie Street and further out of the CBD do not continue this quality of materiality and street treatment.

Overall the urban fabric of Liverpool is fairly inconsistent and there are no clear wayfinding indicators that lead people to and around the city from the various transport nodes. Wayfinding can be achieved as much through materiality and other urban fabric interventions as much as street signage. This needs further consideration.

The opportunity to showcase the significant heritage of Liverpool should not be underestimated. As an example, the TAFE NSW building adjacent the hospital has both the location and significance to become a key hub and attractor in the Precinct with more consideration of highest and best use of the site.



- **Health and Research Zone**
- **Wellness Green Zone**
- **Civic and Entertainment Zone**
- **Retail and Business Zone**
- **Education becomes the linking element throughout the zones**

Focal Zones



Works to the mall have significantly improved the sense of an urban centre in the city. Current planned dispersed development (e.g. moving Civic Place and further developing around the hospital) risks losing the sense of a focal point identity to the city unless clear new differentiated identities are developed. Several clusters of recognisable 'hot spots' or social hubs with different identities can provide a sense of abundance of choice in destination.

There is the potential for four zones to be developed around Liverpool CBD through defining key anchors. Education is scattered through these zones and can become the linking element: the Hospital and Ingham Research Institute define a Health and Research Zone; Bigge Park and the proposed Georges River connections with the new GP Super Clinic can define a Wellness Green Zone; the new Civic Place building and proposed *Eat Street* can define a Civic and Entertainment Zone; and the Macquarie Street Mall and Westfield can define a Retail and Business Zone.

The Council's work with the Office of the Government Architect, along with others, on the 5 gateways may influence future thinking on the development of appropriate focal zones.

Liverpool's Place Potential

Positive aspects of Liverpool's urban centre and issues to overcome



Urban principle

Liverpool Now

Permeability



The original grid implemented by Governor Macquarie in the Liverpool town centre is incredibly amenable for walking and general connectivity. The overall block size is an average of 260 x 120m which is made more permeable by the use of arcades, which effectively reduces block size to 130 x 120m. In contrast, highly walkable areas such as around the Necker Hospital in Paris, have an average block size of approximately 180 x 90m down to 90 x 50m. The use of arcades to keep block size as small as possible should be encouraged in new developments.

Some of the established buildings in the area restricts its permeability. For instance, the presence of the Westfield Shopping Centre distorts the grid pattern and serves to cut walkable access across the city and breaks the link between the Pioneers Memorial Park and the residential development to the north of the city centre.

The hospitals and the schools in the area also take up large block footprints. Opening up the ground plane of these institutions to the general public as 'streets' can increase community connection as well as permeability (see Khoo Teck Puat Hospital case study – Appendix A).

Housing Diversity



Currently, housing in the Liverpool Area is affordable. The Liverpool 2023 website states that the median weekly rent for a three-bedroom house is \$420. Alternately, it was identified that there needs to be a greater high end accommodation for strategic attraction and retention of staff. Some of these developments are currently underway (such as the Papermill).

More focus on lifestyle choice can be encouraged in development applications. Consider the scale of developments that may attract larger developers that can provide a more diverse offering.

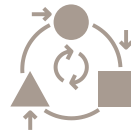
Liverpool's Place Potential

Positive aspects of Liverpool's urban centre and issues to overcome

Urban principle

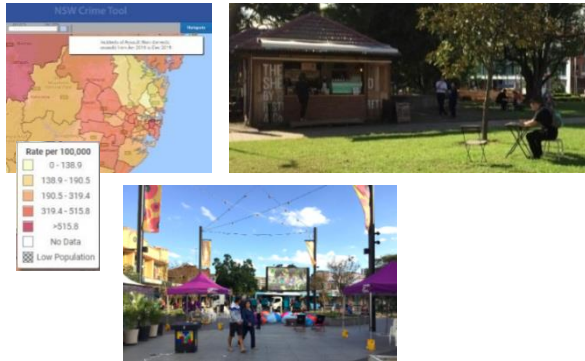
Liverpool Now

Activation



Shared spaces that adapt and can be used for multi-function purposes by different user groups can add to the day and night activation of a precinct. The activation of Macquarie Street Mall into an open air cinema at night or using the Casula Power House as both an art and meeting space is an example of this multi mode use. In addition, some heritage aspects – such as the block in Bigge Park and the TAFE – have been adaptively reused.

Liverpool can work to provide further day and night activation in the CBD area. The NSW Crime Tool statistics and posts to the relocation website homely.com.au lists safety as a perceived issue; activation can help to improve the sense of safety for people in the city at night. Social activities at night also provide opportunities for people to connect.



Catalysers



Catalysers are present across the city from the kids water play area and the chess board in the Mall to café space within the Liverpool Hospital itself. It is important that not all catalysers are 'owned' space or places that require spending money such as cafes and bars.

Cultural events and entertainment spaces are also underrepresented in Liverpool and can be further developed.



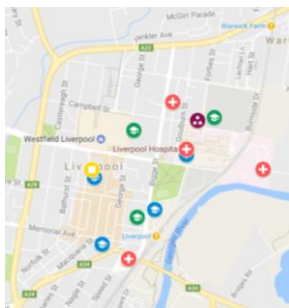
Mix of Uses



The CBD currently has a diverse mix of industry and employment and this should be further encouraged to grow. At the moment the mix is stratified across separate buildings and blocks. This could be further broken down to provide a mix of uses in each building which assists both with connectivity and activation.

Key to the success of this strategy, encouraging better use of mixed use must include getting retailers on board. This has historically been a significant challenge in Liverpool due to culturally and linguistically diverse (CALD) issues and poor service behaviours; significant capacity development would be required to achieve a better service offering.








Availability of quality grade space will be critical to attracting the right mix of tenants and investors. Building more higher grade commercial space is a priority.



Future Liverpool urban principles

An alternative to developing a master plan is to develop a robust set of principles to guide future development in the CBD. The nine urban factors of successful collaborative precincts can be tailored to the Liverpool context to make proactive decisions on new development.



	Urban principle	Liverpool Now
Create distinct focus zones that are easy to identify	<i>Focal Zones</i> 	Align the zones within the precinct with their primary use e.g. health and research/civic and food/retail and education/green zone to create identity and attachment.
Develop the in-between spaces into social catalysers	<i>Catalysers</i> 	Build on the small-scale personal interaction opportunities that already exist in Liverpool and provide more to heighten the sense of community connection.
Mandate cross connections that increase intersections	<i>Permeability</i> 	Retain Liverpool's original grid block sizes and increase arcades or interconnecting walkways to provide a greater number of intersections and options for paths of travel.
Encourage connections across bounding elements	<i>Reach and Limits</i> 	Consolidate development in the core CBD to retain the close reach of the city limits and increase connections across the river, rail and highways to surrounding areas.
Focus on CBD soft transport options and reducing cars	<i>Transport Options</i> 	Consider encouraging cars to stay out of the CBD core by increasing hyper local services, walkability, bike share & bike lanes. Push for increased metro and airport connection.
Support mixed use and shared use developments	<i>Mix of Uses</i> 	Encourage the blending of activities in new mixed use developments and focus on shared facilities for collaboration.
Develop consistent materiality for identity in each zone	<i>Urban fabric</i> 	Expand on the design identity being developed around the mall and Macquarie Street and develop urban fabric language that distinguishes each focal zone.
Provide housing that meets needs across the spectrum	<i>Housing Diversity</i> 	Foster design excellence and create a reputation for supporting quality in design of new developments. Promote housing affordability across sectors and types.
Activate day and night, repurpose and multi use spaces	<i>Activation</i>	Activate interfaces along primary walking routes, have multiple modes of function to ensure facilities are in use day and night, promote mixed use & adaptive reuse.

Liverpool of the future

Liverpool is the global leader in collaboration for health, education and research. This is demonstrated through the interconnectedness and interaction in the city centre.

Liverpool has a well defined core and a concentration of activity in the city centre. This co-location can be further enhanced through active strategies that increase connection between the anchoring institutions and more broadly across the city. Liverpool has the potential to be a premier 'college town' where education is the linking element that ties the city together. Due to their high livability factors and people focus, education cities are often recognised as great places to live for people of all ages and walks of life.

There is a strong urban identity and character that people can relate to and easily identify different areas within Liverpool and navigate around them.

Liverpool already has begun forming clear zones and can leverage these to further define identifiable zones within the Precinct. This will accentuate the local feel where workers and residents in each zone can identify with their area. This zone structure has been used in a number of worldwide best practice health and education precincts. Between these zones, transportation paths and options can be optimised to preference for walking and biking. This catalyses more incidental encounters and the possibility of interaction and connectivity.

The quality of the urban environment conveys that Liverpool is the place to live and rapid economic growth is supported by well thought out development.

A clear set of urban principles can guide future development and ensure quality of the urban fabric. The consistency and treatment of materials and other urban features can convey a sense of pride and purpose both in the community and to external parties.

It is a great place to live, everything is available locally to suit all needs, and there is a welcoming atmosphere.

Liverpool's strength is in its local feel and the close proximity of all services located in the city centre. Building on this by promoting mixed use developments can keep people engaged in the city at night, activate each zone throughout the day and with different user groups, promote walkability through both creating destinations as well as vibrant pathways between zones. By catering for a wide mix of uses and lifestyle options this allows a diverse community to flourish which aids the attraction of key talent. A fundamental component of this is providing housing options across the spectrum of affordability to suit all income levels and lifestyle aspirations.

Liverpool is differentiated by a great number of shared facilities, co-location opportunities and incidental opportunities for interaction.

As a precinct in which all stakeholders are committed to the highest levels of collaboration, Liverpool has a unique opportunity to provide services in new and innovative ways. Shared facilities, open facilities, blurring the line between urban and institution can really differentiate Liverpool from other health and education and innovation precincts. Additionally, Liverpool already has begun creating intimate spaces and opportunities for interaction such as the social spaces in the open air mall and inside the Liverpool Hospital itself. Building on these catalysers can enable more incidental encounters outside of the work environment.

Liverpool is green and easy to get around.

There are great transport links to Liverpool and natural green assets, these can be leveraged along with increased walkability and way-finding strategies to make Liverpool a truly sustainable and liveable community.



What will our people say about Liverpool in 30 years time?

Liverpool 2047 – Collaboration, Connectivity and Coordination

'I like that there are so many different types of people around; I've met many people from all different backgrounds; people that I would love to work with or remain friends with in the future. I'm often studying or coming home late and I've never felt unsafe walking around at night. Liverpool is a really welcoming environment with opportunities for everyone.'

Student



"The rents are lower here than Sydney CBD. I can afford to start bringing my idea to life and with the right people here who have so much knowledge. It's really exciting."



Health worker



"My kids are in schools in the middle of the Precinct around universities, TAFE NSW and researchers. They come home with all these amazing ideas of the things they want to do. I've decided I'm going to try something new too."



Researcher



"I bumped into a colleague from overseas that I haven't seen in years while walking my dog. They are visiting our Precinct to look at relocating here to learn more about our unique collaboration approach."



A woman with dark hair and glasses, wearing a black lab coat and white gloves, is working in a laboratory. She is smiling and looking at a rack of test tubes. She is holding a test tube with a white cap. The rack is orange and contains several test tubes with pink liquid. The background is a laboratory setting with other people and equipment.

How to make it happen




3

3A

Investment attraction

Define available sources of investment from large investors to entrepreneurial/venture capitalists and government

A Precinct is typically made up of a mix of tenants, asset types and site uses with shared spaces and infrastructure, to ensure collaboration outcomes are achieved. Typically, investors have specialist areas of expertise, a knowledge of markets, an investment risk appetite and target rates of return, depending on the stage of the development lifecycle. In assessing private financing options for the Precinct, the available sources of capital will primarily be dependent on the asset class and stage of the development cycle. The following table sets the types of investors in each asset class, and key considerations that will impact investment appetite. **The Action plan outlines next steps for investment attraction to the Precinct.**

Asset class	Residential	Commercial office	Mixed use developments	Health and research	Social infrastructure (Education and health)
Types 	Residential Apartments, Medium Density Housing	Commercial office	Developments with an integrated mix of asset classes (residential, commercial office, hotels, private hospitals) student accommodation and retail space. Could also include retirement and aged care	Private Hospitals, Biomedical, Medical technology, allied health and primary care	<ul style="list-style-type: none"> Design, Build, Finance and Maintain Design, Build, Finance and Operate concessions Primarily financed through availability payments paid by government
Considerations 	<ul style="list-style-type: none"> Demand Current and planned supply Density Pre-sales Access to transport 	<ul style="list-style-type: none"> Planning and Development risks Sourcing Tenants Vacancy and occupancy risk Size and Scale 	<ul style="list-style-type: none"> Master planning Development risk Demand and supply Staging and timing Sourcing tenants, take-out parties or off-the plan sales Mix of capital sources 	<ul style="list-style-type: none"> Co-location and linkages to public health system. Demand from private and public patients Supply of private hospitals in the catchment. Access to specialist workforce 	<ul style="list-style-type: none"> Special purposes asset (no alternative uses eg public hospital) Infrastructure PPP or Operational PPP Government or University tenant with a term of typically 25 to 35 years Assets and/or Operations revert back to government at end of concession
Sources of Private Sector Capital 	<ul style="list-style-type: none"> Listed and Unlisted Residential Property Development Companies 	<ul style="list-style-type: none"> Anchor Tenants Listed and Unlisted Property Development Companies Listed and Unlisted Property Trusts/REITs 	<ul style="list-style-type: none"> Listed and unlisted Property Development Companies with capabilities to deliver developments across asset classes 	<ul style="list-style-type: none"> Anchor Tenant (Research, Bio Tech, Allied Health etc) Private Hospital Operators Listed and Unlisted HealthCare Property Trusts/REITs 	<ul style="list-style-type: none"> Unlisted Direct Infrastructure Funds (Greenfield) Listed/Secondary Infrastructure Funds (brownfield) Institutional Investors

3B

Governance and capabilities

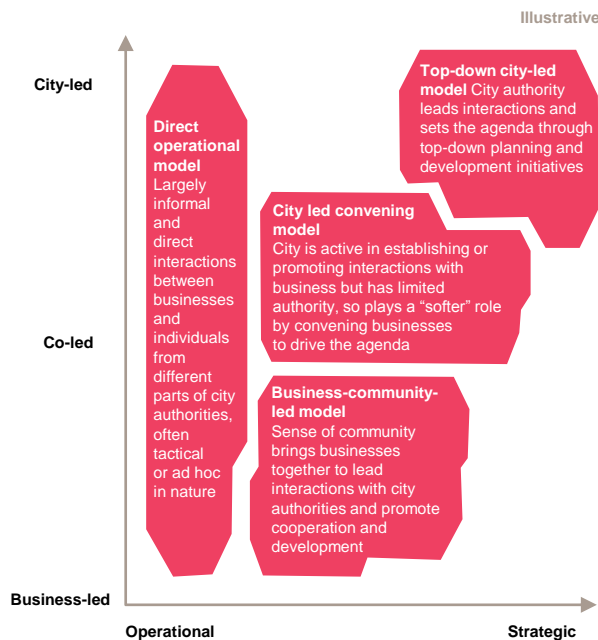
Governance and capabilities

The Global Cities Business Alliance characterised interactions between cities and businesses in terms of whether:

- the interactions are led by cities, by businesses or jointly.
- the majority of these interactions are strategic or operational in nature.

By classifying interactions in this way, interactions can be characterised in the four broad models shown in the following figure.

City-business interactions tend to follow one of four models



The Alliance’s analysis of city–business interactions across this range of models identified a set of key success factors. Each model depends on a different mix of these success factors best suited to its unique circumstances and needs, as shown in the following figure.

Each model relies on a different mix of success factors

● Highest priority ● Generic priority

	Key success factors	Top down city-led model	City-led convening model	Business-community-led model	Direct operational model
City 	Accessible and transparent frameworks and processes	●	●	●	●
	Clear and consistent long-term planning	●	●	●	●
Business 	Representative, cooperative and unified strategic business voice	●	●	●	●
	The use of business expertise to help city authorities overcome challenges and achieve objectives	●	●	●	●
Both 	Formal channels for business to contribute to strategic agenda	●	●	●	●
	Balancing of business interests with broader long-term city needs	●	●	●	●
	Alignment of incentives on strategic priorities (and accountability to deliver)	●	●	●	●
	Ability to invest in development agenda	●	●	●	●
	Direct personal relationships between business and city leaders	●	●	●	●

Our analysis of the Precinct and many stakeholders suggests that a **'city-led convening model'** is the most appropriate typology for consideration as to how the stakeholders should be ordered for success.

Governance and capabilities

This model is often seen in mature cities that possess a strong sense of identity and a clear agenda (as has emerged from this process), but have a city authority (Liverpool Council) that has limited autonomy because of strong regional or national authorities. Such cities typically have fewer direct powers over regulation, tax collection, and spending and investment than those pursuing a top-down city-led model.

In this model, the city authority typically assemble business groups and use independent third-party groups as vehicles for interacting with business.

This is a structure where the city dominates the process, but that it has an ongoing role in facilitating the coordination of stakeholders.

This is consistent with the observation by Cutler (2009) that successful precincts demonstrate the need for:

Some 'natural' market organiser or 'curator' of a putative precinct is needed who functions to broker and facilitate relationships. This role may vary, in function and assignment, over the life cycle of a precinct and may be formal or informal.

Cities following the convening model tend to consult businesses while defining their strategic agenda and then cooperate with them on special projects and initiatives to drive the agenda forward.

The city-led convening model can be a highly effective basis for partnership in situations where a strategic city authority maintains an open dialogue with a representative business community (broadly defined to include the constituent elements of government in the Precinct) through collaborative structures and forums.

The success of the Liverpool Innovation Precinct will fundamentally be shaped by the ability of the Precinct to be distinctive as a true collaborative venture.

The Greater Sydney Commission (GSC) suggests that a 'Collaboration Area' is a place where a significant productivity, liveability or sustainability outcome is better achieved when different levels of government and in some cases the private sector or landowners collaborate on an agreed outcome.

The GSC has specifically suggested (Greater Sydney Commission 2016) that Liverpool be designated as a 'Collaboration Area' noting that:

A strategic whole of government approach to coordinated planning and infrastructure delivery will maximise the investment, productivity and jobs outcomes for the wider Liverpool City Centre. This requires coordinated activities across state and local government, an agreed vision to provide clarity to the private sector for investment and to the community on desired outcomes, and clarity in infrastructure priorities. In response, we have designated the broader Liverpool strategic centre as a potential collaboration area. Subject to the availability of resources, we will work with different levels of government and, if required, the private sector or landowners, to bring together all interested parties to define the area's assets, benefits, potential, governance and funding arrangements.

It would be remiss not to engage with the GSC and to seek its assistance to present a co-ordinated view from the NSW Government.

While the GSC may be this initially, the centrality of place and the local planning powers, suggest that the Liverpool Council is best placed to do this, perhaps in partnership with relevant NSW Government institutions.

Further detail about the recommended governance structure is shown in the next section.

Strategic Priorities for Liverpool - South West District Plan – Greater Sydney Commission

P13: Designate Liverpool as a Collaboration Area Increase in total jobs and increase in total health and education and knowledge and professional services jobs

P15: Plan for the Liverpool Innovation super precinct as part of the Liverpool Collaboration Area Increase in health and education jobs

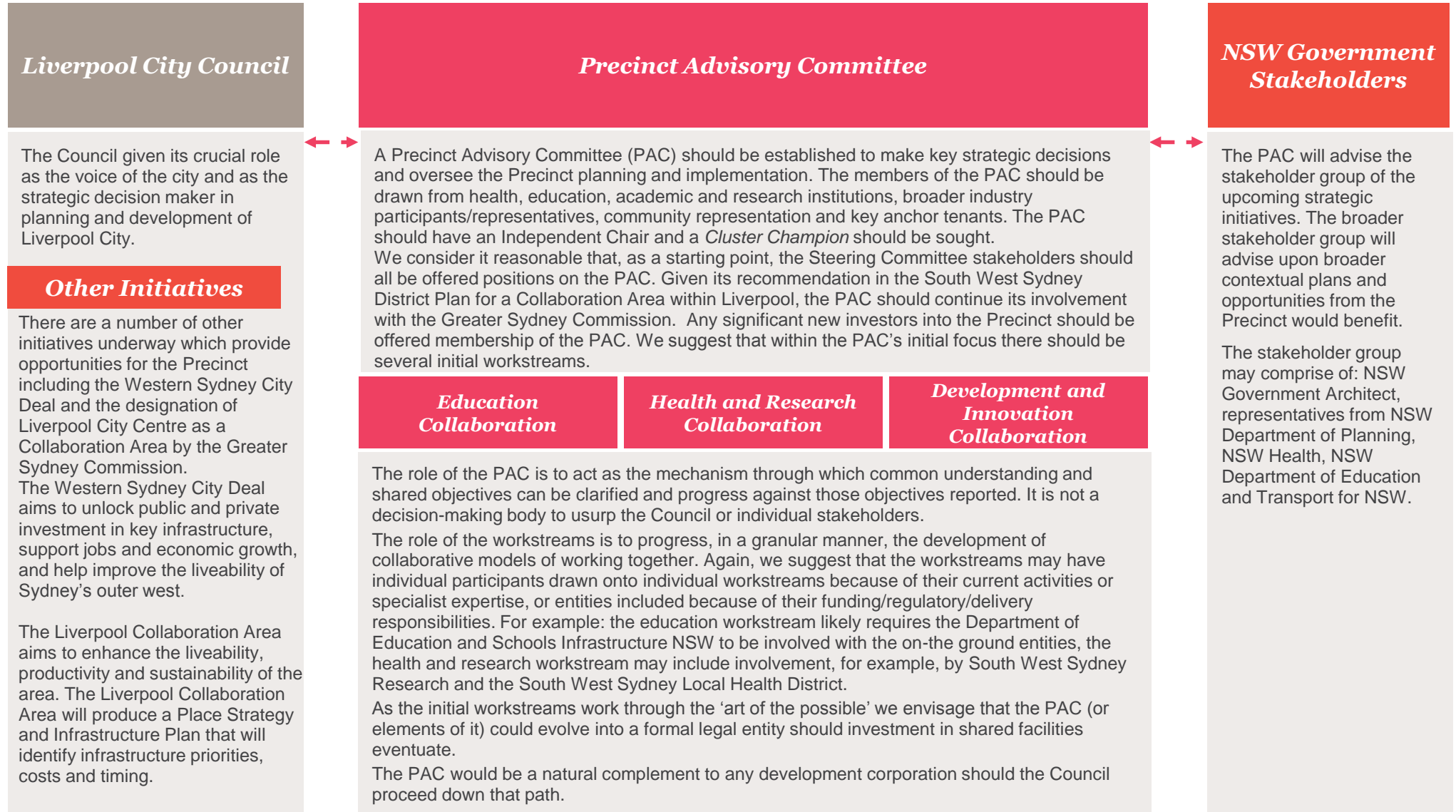


3C

Action plan

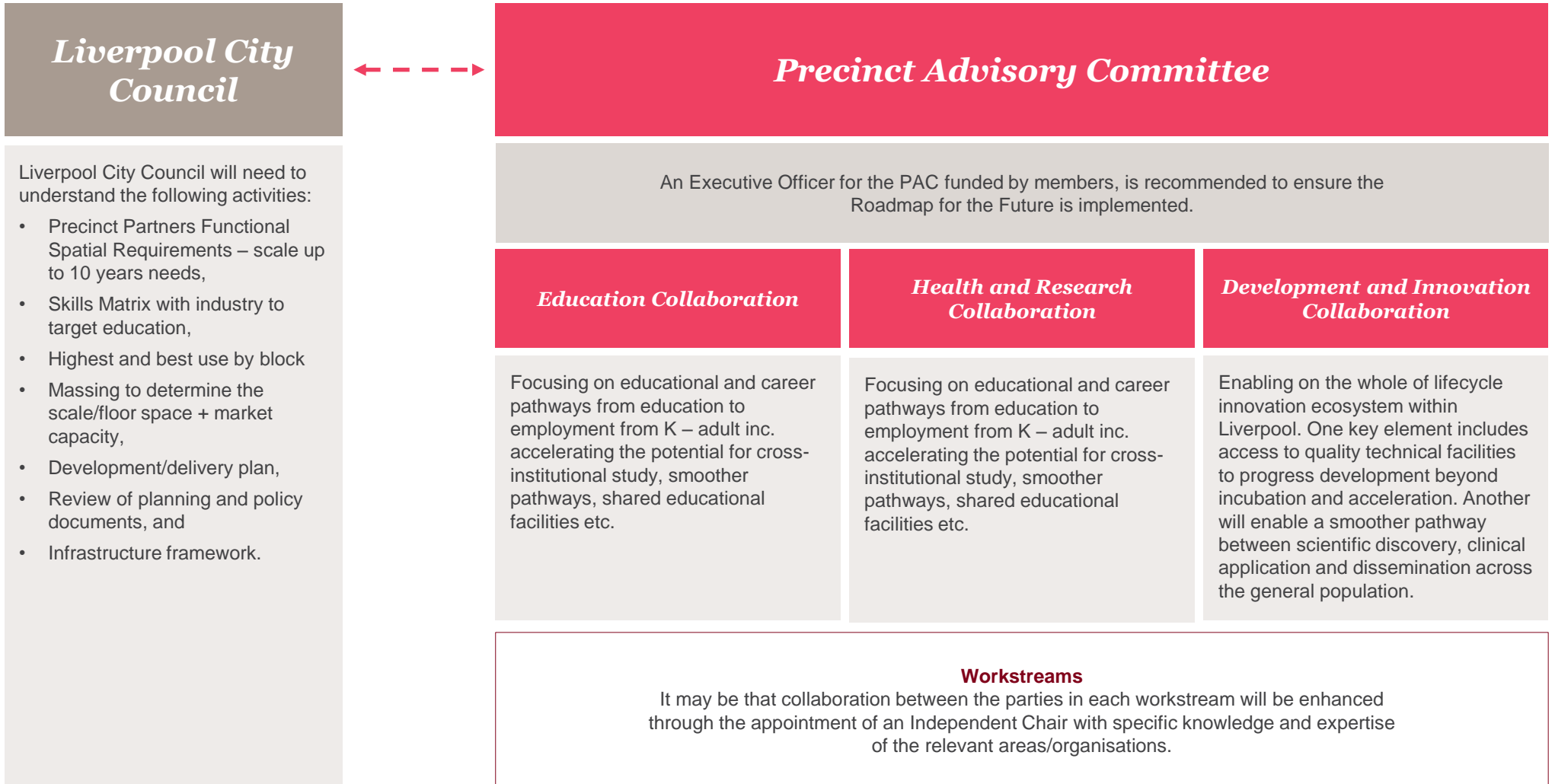
Roadmap for the future

Governance Structure: Role



Roadmap for the future

Governance Structure: First step



Roadmap for the future

Next steps: Phasing of short term priorities

		Immediate	< 1 year	1 – 5 years	At 5 year		
Strategic	Precinct Advisory Committee	Establish PAC & its charter Agree upon strategic focus for future growth, collaboration principles and funding for precinct coordination	Development of an Economic and Investment Strategy	Run an EOI for development partnership	Strategic Review		
	Workstreams	Establish workstreams, their charter and programme management approach	REPORT: Workstreams report to PAC on progress of collaborative behaviours				
	Education	Develop collaboration frameworks within and between workstreams	Develop a Business Case for a P Tech School within Precinct				
	Health and Research		Pursue negotiations with Private Hospital	Establish flagship Centres of Excellent in Cancer and Robotics, Automation and Logistics		Decide upon strategic direction of research Centres	
	Development and Innovation		Identify gaps in the innovation lifecycle and partners who could fill the gaps	Set up pilot site for digital health testing		Forms partnerships with property developers and industry	
Partnerships & Investment	Private	Conduct target industry profiles for potential industry partners	Conduct market sounding for a prospective Precinct industry anchor and industry partners (inc. Prospectus)				
	NSW Government	Pursue Precinct listing as State Significant Development	Identify Government Departments with which there are complementary industries	Identify and apply grants for which the Precinct is currently eligible			
Implementation	Place	Develop land ownership and purchasing framework and agenda	Scoping study – Population density and size required to support vibrant communities	Create a development brief and urban design framework		Identify current planning controls and pathways that enable or restrict development according to the framework	Work in collaboration with Georges River Masterplan to achieve place priorities including housing
	Digital	Integration of and investment in digital infrastructure across the Precinct					

Roadmap for the future

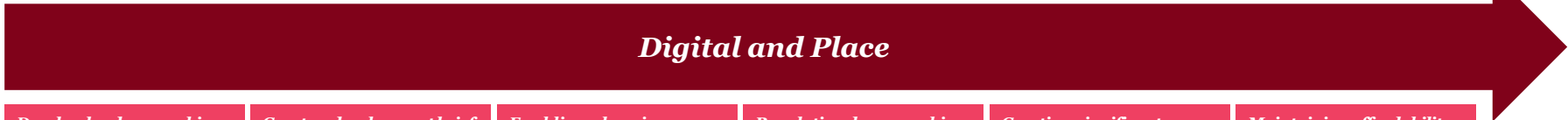
Investment Attraction

Government	<i>Pursue Precinct listing as State Significant Development</i>	<i>Identify and apply grants for which the Precinct is currently eligible</i>	<i>Identify Government Departments with which there are complementary industries</i>
	<p>Highlight the potential to be considered as a State Significant Development:</p> <ul style="list-style-type: none"> • Attracting jobs and industry to the Precinct • Additional funding opportunities. • Greater ability to influence decision making in greater Sydney context particularly in relation to the interconnectivity of Liverpool. 	<ul style="list-style-type: none"> • Department of Industry, Innovation and Science funding through the Entrepreneurs Program inc. accelerating commercialisation, business management, incubator support, innovation connections. • As a Precinct, lobby and apply for grants as a collaborative partnership. 	<p>Potential Government Departments with whom Liverpool Innovation Precinct could form partnerships include:</p> <ul style="list-style-type: none"> • Department of Industry, Innovation and Science • CSIRO including Data61 • Department of Defence – Defence Science and Technology • NSW Ministry of Health • Department of Education • Jobs for NSW inc. Sydney StartUp Hub • Austrade.
<i>Partnerships and Investment</i>			
Industry	<i>Identify existing research partnerships which could be attracted to Liverpool</i>	<i>Conduct target industry profiles for potential industry partners</i>	<i>Conduct market sounding for a prospective Precinct industry anchor and industry partners</i>
	<p>There are a number of significant assets alongside the hospital including the Department of Education and TAFE NSW. There are a number of activities that could be implemented in the Liverpool Innovation Precinct, such as:</p> <ul style="list-style-type: none"> • Sydney Partnership for Health, Education, Research and Enterprise (SPHERE) with \$20 m funding which currently partners with a number of stakeholders in the Precinct (The Ingham Institute, UNSW, WSU, SWS LHD) • The UNSW-TORCH Initiative the Phase One of which involves \$70 m in R&D funding. There is the potential to align Phase Two funding of the TORCH Initiative to the Precinct's research specialisation objectives. <p>Through the specialisation and success of the Precinct, in the future aim for the attraction of funding specifically to Liverpool.</p>	<p>Attraction of an industry anchor will provide key investment in the Precinct as well as create momentum for further investment and create resiliency in the Precinct.</p> <p>Industry segments which are important to attract to Liverpool include: Private Hospitals, industries complementary to Excellent in Cancer and Robotics, Automation and Logistics.</p>	<p>The market sounding will involve: developing a prospectus which will provide potential investors with information on the Precinct as well as conducting interviews with potential industry anchors.</p> <p>Potential participants within market sounding include:</p> <ul style="list-style-type: none"> • Delivery of high quality health services industry anchors. • Corporate incubators and accelerators and corporate Venture Capitalists. Potential anchors may have a digital health and logistics focus through a complex systems approach.

Roadmap for the future

Digital and place

Digital	Integration of and investment in digital infrastructure across the Precinct	Precinct participants optimisation of their city digitally
	<p>Benefits of shared digital infrastructure:</p> <ul style="list-style-type: none"> Improved and shared digital pathways will aid the collaboration process both in terms of speed and security of digital systems. Shared investment and maintenance requirements of digital systems. Efficiencies related to scale of system. 	<p>Digital interfaces can enable Precinct participants to design their own experience of the their city. Liverpool may consider integrating digital elements to future proof the city. Some examples could include:</p> <ul style="list-style-type: none"> wifi hot spots and charging points at specific locations around the city. People can check in along pathways to increase the brightness of lighting at night time.



Place	Develop land ownership and purchasing framework and agenda	Create a development brief and urban design framework	Enabling planning pathways for Precinct development	Population demographics – enabling future Liverpool	Creating significant amenity in Liverpool through collaboration with the Georges River & Warrick Farm Master Plans	Maintaining affordability within Liverpool
	<p>A land ownership and purchasing framework and agenda could include:</p> <ul style="list-style-type: none"> Mapping of existing land owners and land tenures arrangements within the Precinct. An agenda for purchasing land when it becomes available. A Procurement Strategy including engagement with the private sector. 	<p>The development brief and urban design framework could include:</p> <ul style="list-style-type: none"> Development of a Precinct Development Brief and Vision with input from precinct stakeholders, the private sector and the community Definition of site wide and shared infrastructure requirements and plans for investment and maintenance Structuring of development include development of Information Memorandum, Market Sounding, Expressions of Interest and Request for Proposal documentation. 	<ul style="list-style-type: none"> Identify current planning controls and pathways that enable or restrict development according to the land ownership and purchasing framework and agenda. Develop overlays of existing zoning which incentivises development in the Precinct to adhere to Precinct design principles and strategic objectives. For instance, in return for wide footpaths, ground floor transparency of buildings and/or ground floor activation, new buildings will have higher height limits. 	<p>Creating an active and vibrant Liverpool will require sufficient population density, size and composition.</p> <p>Undertake a scoping study in population demographics to understand population requirements to enable the vision which Liverpool seeks to achieve.</p>	<p>One area in which Liverpool has identified needs development is the provision of amenity to improve the retention of highly skilled workers. Improving amenity will also attract start ups and benefit all current and future Liverpool residents.</p> <p>The surrounding Masterplanning currently being undertaken presents a very timely opportunity to create significant amenity within Liverpool.</p> <p>Liverpool Precinct collaboration in the development of the surrounding area is an important next step.</p>	<p>Although Liverpool is affordable at the moment, with the significant investment and development in Liverpool that is occurring currently and will occur in the future, ensuring affordability is essential.</p> <ul style="list-style-type: none"> Affordability of housing is important to primary care workers and well as ensuring the benefits associated with the development of Liverpool are socially and economically inclusive. Affordability of office space is a significant contributor to the presence of early stage start ups. The trend among start ups are that they attracted to affordable office spaces rather than co-working spaces.



Appendices

A

International Precedents and Case Studies

International Case Study

Rochester, Minnesota

Destination Medical Centre (DMC), Rochester, Minnesota

Learnings from Rochester & their relationship to Liverpool

Precincts build on and leverage existing competitive advantages and have a clear focus

The Mayo Clinic is world renowned for providing high quality health care with patients traveling from all over the world. It is with is mind that expansion is aimed. For Liverpool, significant competitive advantages lie in world class imaging techniques, the scale of the Local Health District and diversity of its patients and the strong health related supply chain.

Precincts enable collaboration through catalysers

Within Rochester, public space and creation of bike sharing and bicycle paths are a Strategic Priority. Bicycling is a bike paths – mode of transport where people can see each other and stop and interact. Liverpool already has a number of smaller parks and with the development of the adjacent Georges River area particularly along the river front there is opportunity to create further catalysers.

Precincts have distinct zones and neighbourhoods within them

With the DMC, there are a number of districts each of which have their own specialisation, identity and focal point. A number of distinct zones are already present around Liverpool City Centre – Civic Place, Liverpool Hospital and TAFE NSW. Establishment of an identity for each can be made from aspects which are already present such as green, heritage, community.

Precincts are growth engines for their cities and regions

Significant Government funding has been secured for the development of the DMC as the Government recognises the impact the DMC will have on driving growth for the State. This will occur similarly with Liverpool, as part of the Priority Growth Area, to activate the South West region and Sydney.

Precincts consider how to be integrated with new development and transport priorities

Rochester is currently planning a high speed rail connection to Minneapolis in addition to its international airport. The Liverpool Innovation Precinct needs to plan for significant nearby infrastructure works including the Western Sydney Growth Priority Growth Area, WSA as well as major road upgrades and proposed Metro line.



Overview of the district

Rochester, Minnesota is home to the world renowned Mayo Clinic and is a 2nd city to Minneapolis. To capitalise on their existing health and education competitive advantage, the Destination Medical Centre (DMC) is currently under construction.

It comprises of a 20 year US\$5.6 billion investment in the precinct through a combination of public and private funding. Significant foreign investment for the DMC from United Arab Emirates and China.

The DMC aims to drive growth for Rochester and Minnesota through Health and Bio Tech innovation and become a world leader in highest quality medical care.

Local Case Study

Springfield Health City, QLD

Springfield Health City, Greater Springfield, Queensland

Learnings from Springfield Health City & their relationship to Liverpool

Precincts designed as a place to stay for life

One of the key strengths of Greater Springfield is the rich generational diversity of the people who live and work in it. Greater Springfield integrates residential, education from pre-kindergarten through to university, workplaces and aged care facilities. The founder of Greater Springfield has a 'cradle to grave' ethos where people are enabled to live, learn and work for their entire lives. This is also an aspiration for Liverpool to build a place where people want to stay throughout their lives.

Precincts have anchors as a focal point

Within Health City, the anchor institutions, public and private hospital, and the area just around them serve as the focal point for the precinct with range of businesses radiating from that in a spoke and wheel formation. Liverpool Hospital has been described as the Heart of the City and due to its proximity to Bigge Park, creation of the central focal point in this location would be ideal.

Precincts are permeable within and between adjacent areas

Importance has been placed on visual and physical permeability within Health City and between adjacent Cities to increase connectivity. The intention of this is for the people in each city to walk through other cities, to interact with each other and ideally working together and creating innovation. Currently, there is no significant interconnection between stakeholders in the district and importance needs to be placed on this.



Overview of the district

Greater Springfield is a newly created 2nd of Brisbane which contains three distinct cities each of which have their specialisation: Health, Education and Idea City, with anchor institutions or businesses present in each city.

Springfield Health City encompasses 52Ha and envisages becoming an integrated health precinct which delivers quality healthcare, medical education and research as well as aged and seniors living.

Delivery of this precinct has commenced with Mater Private Hospital Springfield and \$21.4 million in Australian Government spending for a cancer centre.

International Case Study

Corridor, Manchester

Corridor Manchester

Learnings from Corridor Manchester & their relationship to Liverpool

Precincts create effective collaboration through partnership

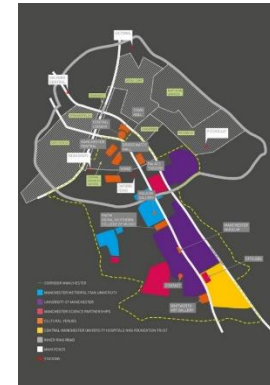
Corridor Manchester is a partnership between Government, Hospital, University, Commercialisation and Industry partners. By working in partnership, partners have been able to secure investment and drive innovation producing job creation and economic growth. Although the supply chain in health is strong in Liverpool, some elements enabling innovation such as start ups, investment and commercialisation need to be strengthened. Formation of partnership and strong Governance structures will enable Liverpool to achieve its vision.

Precincts are designed for the people they want to attract

Corridor Manchester aspires to be as a place to live, visit and work for students and knowledge workers from across the world. A lively social scene has benefited from major new cultural investment and a very large young and international population. Liverpool currently has a strong and diverse community with a variety of cultural activities throughout the year. Creation of spaces and places which enable the liveability of the new residents Liverpool wants to attract is important. One way in which Corridor Manchester does this is by placing culture at the heart of the city through both day and night time activities. One way to do this is through planning of walkable and activated streetscapes between Liverpool train station and Liverpool Hospital.

Precincts enable and drive economic and social inclusion

In the suburbs nearby Corridor Manchester, families experience higher rates of unemployment, lower household incomes and lower rates of educations. As a result, they struggle to access employment opportunities within the Corridor and Manchester city. One way in which the Corridor partnership addresses this is through apprenticeships and training to enable local employment within the supply chain as well as connection between Corridor workers and local schools to raise the aspiration of students.



Overview of the district

Corridor Manchester is a “corridor” of innovation 2km south of Manchester CBD. The presence of several anchor institutions, hospitals and universities as well as research institutes, co habit along with Manchester Science Partnerships (MSP) a leader in commercialisation.

The focus of Corridor Manchester is to catalyse collaboration/partnerships and accelerate healthcare innovation (biomedical science transformation, diagnostics, treatments and services).

By 2025, Corridor Manchester aims to be:

Manchester’s cosmopolitan hub and world-class innovation district, where talented people from the city and across the world learn, create, work, socialise, live and do business; contributing to the economic and social dynamism of one of Europe’s leading cities.

International Case Study

Khoo Teck Puat Hospital (KTPH)

Khoo Teck Puat Hospital, Yishun, Singapore

Learnings from Filler & their relationship to Liverpool

Precincts which are design led can be successfully delivered

The design for the hospital precinct was the winning entry from an international design competition. Rather than prescribing floor heights or footprints, the qualities of the building in performance produced its design. Elements of the design brief included: 'hassle free hospital', 'patient centric', 'energy efficiency' and 'technology as an enabler'. A similar design led or design brief approach could be developed for Liverpool rather than conducting a more traditional master planning approach.

Precincts are designed to be green and sustainable

The core concept of the design is 'hospital in a garden, garden in a hospital'. The gardens surrounding the buildings were landscaped to be 'healing gardens' to improve the wellness of staff and patients. One of the key elements of the design was that the building be sustainable which led to the building achieving the highest rating in Singapore's Green Mark programme. In addition, the energy use of the KTPH is 30% less than comparable hospitals in Singapore. Placing green space and sustainability at the centre of design and performance indicators enabled this success. This could be replicated in the design and remediation of buildings and spaces in Liverpool. For instance, the pocket gardens and parks throughout the Liverpool precinct play an important role in the wellbeing of students, staff and patients. The revitalisation of these spaces will greatly enhance the well being of those within Liverpool.

Precincts have a patient and community focus

The vision of the KTPH precinct was to place "patients unambiguously at the centre of the focus". This vision was set prior to the construction of the hospital and was a core element in the design. One way in which KTPH created a 'hassle free hospital' was to design for ease of interconnection between the hospital and surrounding areas through walking ways, shuttle buses and public transportation. Liverpool Innovation Precinct connectivity within the precinct and beyond can significantly improve the use of the precinct.



Overview of the district

The Khoo Teck Puat Hospital (KTPH), which opened in 2010, was designed with the well being of staff, students and patients in mind. KTPH is a 590 bed tertiary hospital which serves more than 700,000 people per year.

The design of the KTPH was won numerous including 2011 SIA Architectural Design Award for Building of the Year and Design of the Year. The design utilised new and existing technologies in its focus for greenery and sustainability.

International Case Study

Texas Medical Center

Texas Medical Center, Houston, Texas

Learnings from Filler & their relationship to Liverpool

Precincts enable whole of innovation lifecycle

Brookings Institution describes TMC as the connective tissue between anchor institutions in Houston. In more recent years, with TMC vision of 'bench to bedside' innovate institutions and enables start ups to collaborate with researchers, scientists and clinicians. The TMC Innovation Institute encompass the entire innovation lifecycle from early stage start on with TMC Innovation Institute which brings together all 57 medical center ups (TMCx+), to prototyping start ups (TMCx), to testing and developing start ups in partnership with industry – JLABs (JLABs@TMC) and Center for Device Innovation (CDI@TMC) in partnership with Johnson & Johnson the Foundry for Connected Health with in partnership AT&T. TMC is also building an innovation campus "TMC3". The whole of lifecycle capability enables ideas and solutions to grow and stay within the TMC. TMC Innovation Institute has been a deliberate investment unified with a strong vision which leverages from its existing strengths and competitive advantages. Liverpool will need to design to enable the whole of the innovation lifecycle to replicate a structure similar to that which has been developed in TMC.

Precincts thrive on private investment and partnerships

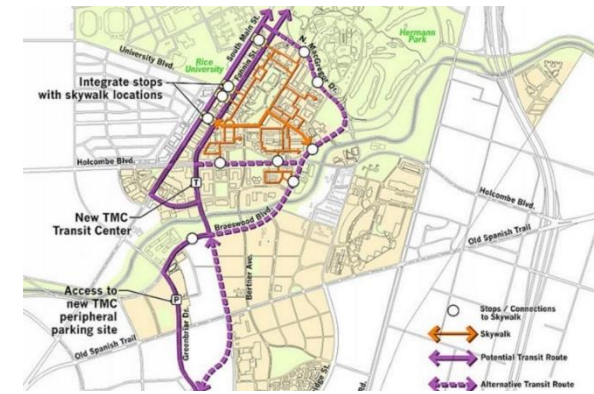
JLABs @ TMC will accommodate up to 50 life science start ups, encompasses 3100 sqm of floor space with 40% of space dedicate to labs. These include prototyping and concept labs as well as chemistry and biology labs. JLABs @ TMC also connects entrepreneurs with Johnson & Johnson Innovation which includes opportunities for access to funding, attend networking and educational events and to R&D experts.

The attraction of Jlabs to TMC produced an industry anchor institution which create a tipping point and accelerated the attraction of other industry anchors – including AT&T – to the TMC. The presence of multiple industry anchors already creates economic resiliency for the precinct. With the Liverpool Innovation Precinct unified vision, Liverpool could look toward organisations with which it would aim to partner and develop.

Precincts benefit from co location

TMC Innovation Institute enables the colocation of Jlabs@TMC, CDI@TMC, AT&T Foundry for Connected Health, TMCX and TMCX+. The benefit of colocation is not only shared services, which encompasses over 9000 sqm of state of the art innovation and lab space, but also being physically present with knowledge, experience and specialisations across the whole spectrum of health, education, research and innovation.

Liverpool will need to imbed elements of each Health, Education and Research within each organisation to benefit from each organisation presence within the precinct. Although this could be in the form of the construction of a new Liverpool Innovation Institute similar to TMC, this could also be through the creation of co-working and start up space within universities or lab facilities open to start ups within the hospitals or lectures to universities within research institutes.



Overview of the district

The Texas Medical Center (TMC) encompasses 675 acres, is the city's largest employer and has a day time population of 70,000 medical professionals, support staff, students and patients. Due to its size, the TMC is one of the largest teaching hospitals in the USA.






The TMC houses 57 separate institutions and is within walking distance of Rice University.

TMC identified its need to diversify and in recent years has made a significant push toward bench to bedside innovation.






B

*Liverpool infrastructure investment
pipeline*

Liverpool infrastructure investment pipeline

 <i>Investment</i>	 <i>Description</i>	 <i>Value</i>	 <i>Commencement</i>	 <i>Milestones</i>	
Moorebank Intermodal Terminal	<p>The Terminal will provide a rail 'port shuttle' between Port Botany and the Moorebank precinct, a separate terminal for interstate freight and warehousing. The site is adjacent to the existing dedicated freight railway line, the M5 motorway and close to the M7 motorway.</p>	\$1.675b	2017	Import-export terminal operational in late 2018	Interstate terminal operational in 2020
Western Sydney Airport	<p>The first stage of construction involves construction of a single 3,700m runway with a parallel taxiway, associated aviation terminal infrastructure and support precincts. Additional expansion over time through to 2064.</p>	<p>\$5b – stage one, including a single runway, terminal and civil works \$38b – further works to expand the airport to its full potential – including a second runway, roads, rail access and other surrounding infrastructure such as shopping precincts</p>	2017	Operations begin 2016	
Georges River Master Plan	<p>Georges River Master Plan, which proposes a long-term vision for the potential urban renewal of the Georges River Precinct. The precinct is located between the Liverpool City Centre, Anzac Creek and the South-Western Motorway. The Master Plan hopes to create a true river city that has a vibrant mix of uses and activities.</p> <p>The plan envisages a connected and walkable precinct which provides generous public access to the river front and improved connections across the Georges River. The plan proposes a range of housing types and densities (from low to high) and explores a mix of employment opportunities which will be responsive to our changing economy. The plan provides a framework for growth over a period up to 2050, but makes no changes to current planning rules.</p>		Stage 1 completed by 2030		

Liverpool infrastructure investment pipeline

 <i>Investment</i>	 <i>Description</i>	 <i>Value</i>	 <i>Commencement</i>	 <i>Milestones</i>	
Southwest Metro Line Extension	The potential extension of the Metro line to Liverpool will improve its integration with the rest of Sydney, helping to sustain growth in Liverpool and enhance its liveability. At the same time, demonstrating that the Study Area is proposed to accommodate significant population growth will strengthen the case for the extension of the Metro to Liverpool.				
Bringelly Road Upgrade Stage 2	The project complements an earlier project to upgrade Bringelly Road between Camden Valley Way and King Street and is now under construction. The Stage 2 project upgrades the remaining 4.3km of two-lane rural road between King Street and The Northern Road to a four-lane divided carriageway with a wide central median.	\$172m	Construction commences in 2017		Construction concludes by 2019-20
The Northern Road Upgrade (between Peter Brock Drive, Oran Park and Jamison Road, South Penrith)	<p>The Northern Road is a key north-south road in Western Sydney that provides access for freight and passenger transport accessing the M4 Motorway, Penrith, Glenmore Park, Mulgoa Rise, Orchard Hills, Luddenham, Bringelly and WSA.</p> <p>The project upgrades a 31km section of the Northern Road between Peter Brock Drive and Jamison Road .</p> <p>A majority of the upgrade will be built as a four-lane dual carriageway road, with two dedicated kerb-side bus lanes.</p> <p>Provision is made for future expansion if required. Sections to the north of Glenmore Parkway will be upgraded to a six-lane dual carriageway, with two dedicated kerb-side bus lanes.</p>	\$1.632b	Commence construction 2017		Conclude construction 2020

Note: Corridor preservation is a process to identify and preserve an area of land for future transport use. Corridor preservation is also occurring in areas that affect accessibility to and around Liverpool (Transport for NSW 2016), and foreshadow future investments, including:

- Outer Sydney Orbital – Transport for NSW is investigating a suitable corridor for the Outer Sydney Orbital to provide a north-south connection for a future motorway, and freight rail line. Where practicable a passenger rail line could also share part of this corridor. The corridor will provide increased capacity for the road network to improve accessibility to housing and employment opportunities in Western Sydney. It is also expected to provide for a future freight rail connection from Port Kembla to the South, Western and Northern Lines.
- South West Rail Link Extension – The extension corridor is proposed to connect Leppington Station to Bringelly and then head in two directions: north to the Western Line near St Marys; and south to Narellan. Extension of the corridor further south to the existing South Line is also under consideration.

C

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D

Overview of Precinct partners

Overview of Precinct partners

A key feature of Liverpool is the established group of health, research and education institutions with existing strong collaborations and partnerships. There is potential for further innovation and commitment to collaboration by the participants as part of a Liverpool Innovation Precinct.

Liverpool Hospital – South Western Sydney Local Health District

A part of South Western Sydney Local Health District (SWSLHD), Liverpool Hospital is a comprehensive multi-purpose integrated research, teaching and referral hospital with 850 beds, 60 intensive care beds and 23 operating theatres.

Liverpool Hospital is a principal referral group A1 hospital with tertiary affiliations to the UNSW and WSU. It provides referral and district acute services to the Liverpool catchment and higher level tertiary care for South Western Sydney residents including critical care for rural retrieval catchments and a supra regional catchment in brain injury. Each year, Liverpool hospital has over 70,000 emergency department presentations, 70,000 inpatient occasions service, 3000 births and 700,000 outpatient appointments.

The Hospital provides a wide range of diagnostic and imaging services, emergency and trauma care, maternity, paediatric, cancer care, mental health, ambulatory care, allied health and medical and surgical services from birth to aged care. It also provides a range of state-wide services in areas such as critical care and trauma, neonatal intensive care and brain injury rehabilitation.

As a leading tertiary training facility, Liverpool Hospital trains a broad range of nursing, allied health, medical and health management students from WSU, UNSW and UOW. A significant proportion of this teaching and experiences is delivered through UNSW SWS Clinical School.

The hospital has undergone a major \$390million redevelopment has increased the capacity of the hospital to new Clinical Services Building, major refurbishment of the existing Clinical Services Building, extension of the Cancer Services Centre and a new Sub-Acute Mental Health Facility. Further redevelopment is proposed to cater for demand to 2021 with key operational and capacity development priorities for the Hospital include aged care and rehabilitation, chronic disease, complex care, internal medicine, cancer, critical care, medical imaging, mental health, women's and children's health and surgical programmes.

South West Sydney Primary Health Network

South Western Sydney Primary Health Network (SWSPHN) is a not-for-profit health organisation dedicated to supporting general practitioners, practice nurses and other primary health providers to deliver the best possible care for their patients and improve access to quality local health care for the whole community.

SWSPHN has a broad remit to support local clinicians; understanding the health care needs and service gaps in our community through planning and consultation; commissioning appropriate services to address those needs for those of the community at risk of poor health outcomes. To achieve these goals SWSPHN partners with the community and local clinicians through the local Community Advisory Committee and Clinical Council which brings together GPs, other primary care providers, and the South Western Sydney Local Health District.

SWSPHN has nationally align goals of reducing avoidable hospital admissions and increasing cancer screening rates, immunisation and mental health treatment rates. In addition, through a comprehensive needs assessment, the community has identified local priority areas including mental health, chronic disease, tobacco control, overweight and obesity, cancer, pregnancy and the early years, strengthening prevention, advocacy, information, workforce, Aboriginal health, culturally and linguistically diverse communities, aged care and drug and alcohol treatment.

SWSPHN, as a commissioner of outcomes and a [supporter] of General Practice will be the critical interface between primary, secondary and community care, ensuring an integrated health system with continuity of care for all people that is equitable, patient centred, increases health literacy and delivers care closer to the home.

Overview of Precinct partners

Ingham Institute of Applied Medical Research

The Ingham Institute for Applied Medical Research (IIAMR) is a translational research institute focused on exploring new medical approaches, breakthroughs and clinical discoveries across its five research streams of cancer, clinical science, population & health services, injury and rehabilitation and mental health. The Institute is a collaboration between South Western Sydney Local Health District, WSU and UNSW. Operating from the Liverpool Hospital campus, all of the institute's medical research programs have a translational focus.

The Ingham Institute comprises a state of the art research precinct located at Liverpool Hospital consisting of a Research Building, a Clinical Skills & Simulation Centre and a Research Bunker containing the MRI-Linac, a unique cancer therapy technology that will be an Australian-first.

The Ingham Institute has more than 40 research groups that are divided amongst its five research streams of cancer, clinical sciences, population and health services, injury & rehabilitation and mental health. The Ingham Institute prides itself in its translational approach to research programs and promotes a strong collaborative approach amongst researchers and clinicians, leading to improved outcomes and more medical breakthroughs.

Ingham Institute's Clinical Trials Unit is designed to foster close working relationships between clinicians, pharmacy, pathology, finance, human resources and the executive team to enhance clinical trials capability. As a result of the Ingham Institute's partnerships with the South Western Sydney Local Health District, WSU and UNSW, the group can facilitate unique collaborations with hospital based principal investigators and key university researchers to build capacity for early phase clinical research.

More information about key and research strengths of IIAMR can be found at <https://inghaminstitute.org.au/content/our-research-streams>

Liverpool City Council

Liverpool is one of Australia's oldest – and fastest-growing – cities.

The CBD skyline is being transformed – with work beginning on a billion dollars' worth of new projects and its economic growth is outstripping the rest of Sydney and the state of NSW.

A range of businesses have taken advantage of our skilled population to put down roots in Liverpool contributing to over \$9b of the local economy. Our transport connections – and proximity to the Sydney market and, through WSA, on to the rest of the world – provide businesses with a competitive advantage.

The Intermodal at Moorebank will generate thousands of jobs and bring billions of dollars in economic benefits.

Liverpool is undergoing a transformation into a collaborative, walkable University City, with Liverpool Hospital - Australia's largest standalone facility - at the hub of an emerging health and education precinct.

The Ingham Institute for Applied Medical Research hosts some of the nation's leading medical researchers and, with three major universities putting down roots, Liverpool is poised to be the educational centre of the Great South West, offering limitless potential for a young population.

Liverpool's strong manufacturing heritage presents unique opportunities in the health sector in the development of robotics, medical devices, prosthetics and pharmaceuticals.

Some \$13 billion worth of major infrastructure projects will be constructed in Liverpool within the next decade. From the rural hinterland, through new land releases to CBD high-rise projects, Liverpool is alive with opportunity.

We have revitalised our public spaces to reflect the vibrancy of our population and we're embracing the potential of the Georges River. Casula Powerhouse is at the forefront of creative innovation, and hosts our award-winning Children's festival, Way out West.

Liverpool is growing fast, with 100 new residents every week.

We are the young, vibrant face of modern multicultural Australia – reflecting the best of 150 nations.

For further information, please visit: www.liverpool.nsw.gov.au

Overview of Precinct partners

Western Sydney University

WSU is Australia's principal university in South Western and Western Sydney with over 45,000 students studying in the region. WSU is ranked amongst the top 3% of universities in the world, with a growing international reputation for research-led, student-centred and technology-infused learning.

WSU has extensive partnerships with Liverpool Hospital and investment in the region with over 1,450 nursing students, 36 medical students, and more than 60 specialist research positions concentrated within the Liverpool Innovation Precinct and surrounding health network alone.

The University's School of Nursing and Midwifery is one of the largest and the highest independently ranked programme in Australia. WSU's Liverpool Campus, accommodates over 2,500 students. Course offerings at this technology-rich high-rise 'downtown' campus include nursing, social science, criminology, criminal and community justice, social work, policing, anthropology and community welfare.

Liverpool is also a critical focal point of WSU's work in supporting innovation, industry engagement and research collaboration. Since 2015, the University's 'Launch Pad' technology business incubator has been working with the City's startup and tech-SME community to identify, amplify and retain Liverpool's extensive capacity in this emerging area. Working with international and local corporate, federal and state government partners, WSU is bringing additional expertise to this initiative via its 'Living Labs' research project and world-leading MARCS Institute research on optimising machine-human interaction, IoT, robotics and automation.

The work that MARCS and related areas of research, teaching and industry-engagement activation are bringing to Liverpool will ensure it is recognised as a catalytic site for digital and technological transformation. These initiatives position Liverpool to lead rather than be passively subject to the impact of labour-market and industry disruption. The University is positioning these resources at Liverpool precisely because of the region's latent and existing strengths in innovation, collaboration and organisational agility.

WSU's contribution to regional labour-market and economic uplift in Liverpool has been independently calculated at \$54 million per year. This substantial value-add will only grow in coming years. Based on current trends, the University's enrolments across Liverpool and surrounds will exceed 15,000 students by 2030. This unequivocally affirms Liverpool as one of the most critical and large scale higher education and research concentrations in Australia and indeed, South East Asia.

More information about key health and research strengths of WSU can be found at: <https://www.westernsydney.edu.au/research>

University of New South Wales

UNSW is a world leading university with significant investment and performance in health and research within the Liverpool region. UNSW has research activities, strong industry links and regional and global engagement which enhances teaching.

UNSW is heavily invested in the Liverpool area through the South Western Sydney Clinical School (SWSCS) At Liverpool Hospital and investment and ongoing investment in the research infrastructure in the Ingham Institute.

The UNSW Faculty of Medicine has nine schools, a number of centres and institutes, and associations with several affiliated medical research institutes and facilities. Liverpool Hospital is UNSW's largest clinical school accommodating around 100 interns per year. UNSW is also partnered with WSU and the University of Wollongong to share curriculum and teaching resources and collaborative research projects. As part of this collaboration, UNSW also provides teaching support for 20 interns from the Western Sydney University's Medical School. UNSW manage Liverpool Hospitals Ingham Institute Skills and Simulation Centre on behalf of a partnership between the LHD, UNSW and WSU. This Centre is a state-of-the-art education facility providing training at a range of levels from undergraduate to prevocational and vocational training for students and staff of the Hospital and LHD.

A combination of excellent facilities, a dedicated academic and conjoint workforce and access to Sydney's fastest growing urban centres put SWSCS in a position to lead the development of innovative clinical teaching practices within UNSW Medicine. The School has also had a leading role in the enhancement of the research environment in south western Sydney, including an increase in research grants held; publications produced and postgraduate research students enrolled in recent years.

Areas of research strength for enhancement at UNSW include oncology and medical imaging, aged and palliative care, diabetes and obesity, critical care research and substance abuse and drug health. SWSCS staff play a leading role in the development of both clinical and academic medicine within SWSLHD.

More information about key health and research strengths of UNSW can be found at: research.unsw.edu.au

Overview of Precinct partners

University of Wollongong

UOW is a research-intensive university with an outstanding reputation for its learning environments across a broad range of disciplines. It has an international network of campuses and regional learning centres, with the South West Sydney campus being opened in Liverpool in 2017. UOW is ranked in the Top 2% of global universities and is also ranked in the Top 50 universities around the world under 50 years since foundation.

UOW is currently offering courses from its business, health, engineering, social sciences and arts faculties to meet the demands of the Great South West. The courses are currently operating from a campus within the Liverpool Administration Council building. The campus will expand into the civic place development from 2020, with the student population expected to grow to 7000 students by 2030.

Currently nursing, exercise science and rehabilitation and dietetics students are undertaking places at Liverpool hospital and rehabilitation and aged care facilities. Medical (through the SWSCS) Around 330 Nursing students undertaking placements in local hospitals, mental health facilities and aged care facilities. Students from the School of Education are undertaking professional experience at around 20 partner schools, providing approximately 150 placements in the Great South West area.

From 2020, UOW will provide nursing courses through the new Western Sydney Nursing Education and Research Centre (WeSNER) with 700 nurses working at Liverpool hospital and other placement locations in the region. The proposed WeSNER Health Clinic is also planned to provide professionally supervised health services to the general public, while educating students in healthcare practice.

UOW is also building partnerships with local industry such as the long-term agreement with Liverpool-based multinational manufacturing company Daikin Australia – one of the largest manufacturing enterprises in the region. This major partnership will include research opportunities, product development, internships for business, ICT and engineering students.

More information about key health and research strengths of UOW can be found at: <http://www.uow.edu.au/research/index.html>

TAFE NSW

TAFE NSW is Australia's leading provider of vocational education and training with over 500,000 enrolments each year.

Our ambition is to be the brand in global demand to build skills for success in today's and tomorrow's world.

TAFE NSW offers the best of campus-based delivery as well as flexible, online and work-based learning. In Liverpool TAFE has facilities based in the Liverpool CBD and at Miller. Liverpool campus includes the historic Francis Greenway building adjacent to Liverpool Hospital.

Collaboration, diversity and the strong relationships between our locations contribute to and magnify the value of TAFE NSW and importantly, the benefits that we deliver to communities and the economy of NSW.

We're committed to our students and customers and the role we play in changing lives and opening up opportunities through learning.

We offer a range of vocational courses including short courses, and certificate to Diploma and Advanced Diploma level. TAFE NSW is also registered as a higher education provider and offers degree level programmes across a range of vocations.

TAFE NSW fulfils its role as the public provider by:

- providing a state-wide service
- offering a broad choice of courses
- providing inclusive services
- delivering skills critical to the NSW economy
- leading quality, innovation and customer focus in service delivery
- operating as a sustainable business
- being an employer of choice.

For more information, please visit: www.tafensw.edu.au

www.pwc.com.au

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