Case Study:
Western Sydney University
New Science Centre,
Parramatta Campus, NSW

Shane Wood, dwp|suters

September 2016

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450 People

12 Studios

9 Countries

4 Portfolios

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Lifestyle
Hospitality
Residential
Retail
Community
Health
Education
Seniors Living
Sport + Leisure
Civic
Work
Workplace
Banking + Finance
Infrastructure
Transport
Industrial
Masterplanning
Defence
Resources
Portfolios
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Agenda

1. Project Overview
2. Challenges & Opportunities
3. Approach
4. Sustainability
5. Innovation

Project Overview

Understanding the Brief

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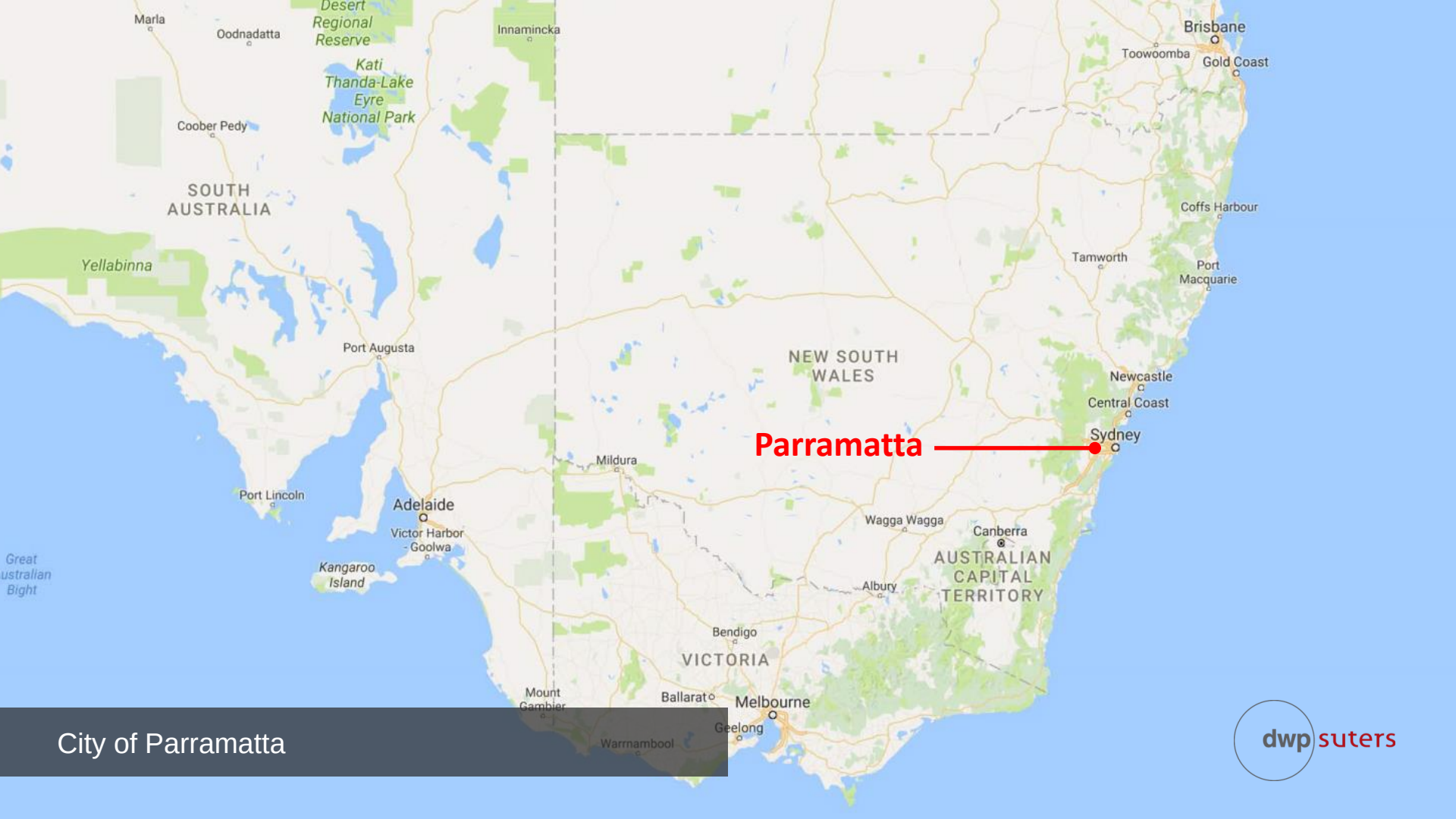

City of Parramatta

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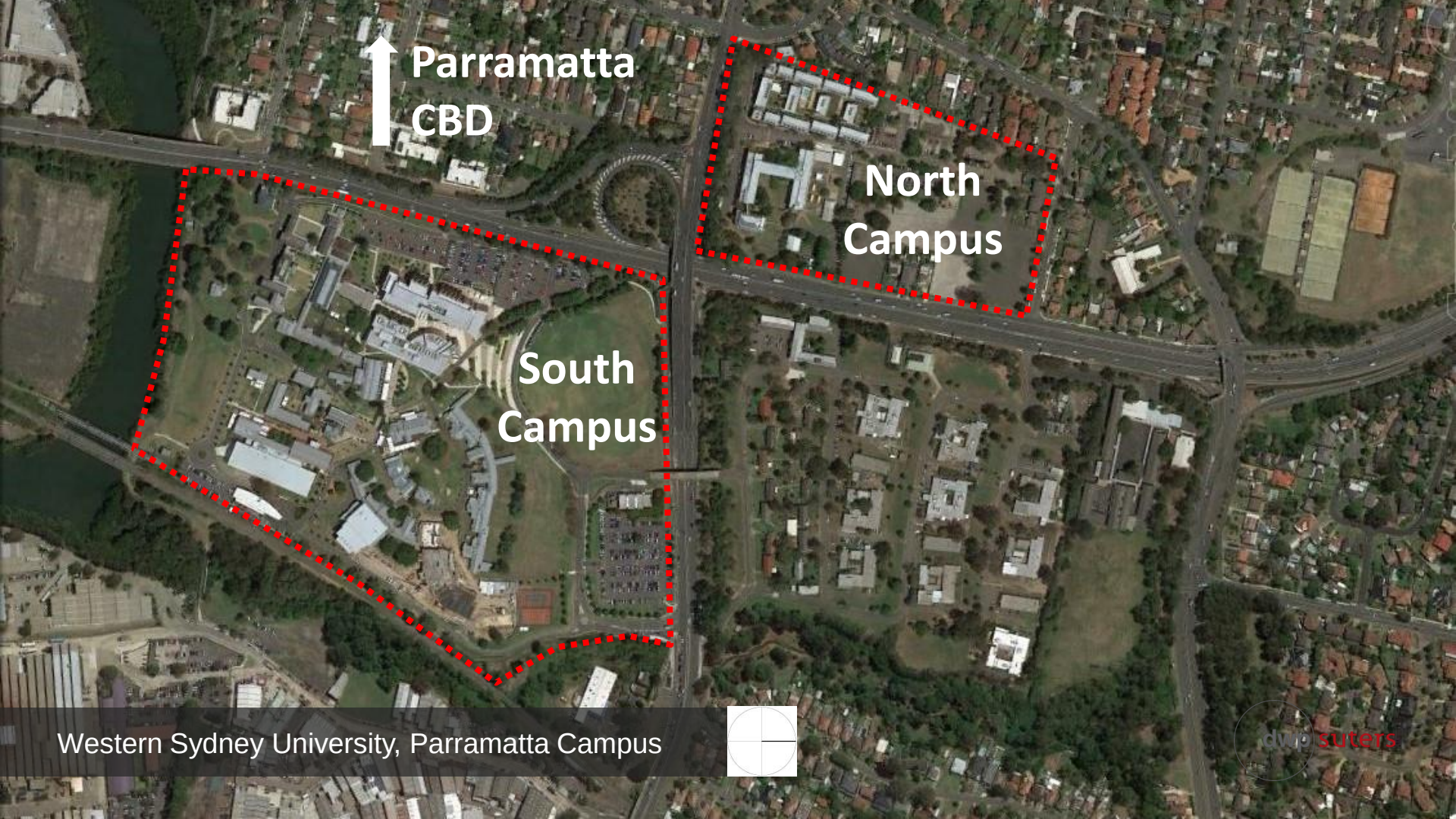

Western Sydney University, Parramatta Campus

Brief

- **New Teaching & Research Science Facility**
  - Physical, Chemical, Geo and Biological Sciences
  - AMCF (Atomic Molecular Characterisation Facility)
  - Social Science & Psychology added to the brief during design
- **Objectives**
  - New state of the art science facilities
  - Increase student numbers by 25%
  - Increase academics and researchers by 50%
- **Budget: $25 million**
- **Floor Area**
  - Gross Floor Area – 5,780sqm
  - Useable Floor Area – 3,015sqm
- **Formal GBCA 5 Star Green Star facility**
- **Program: July 2013 – August 2016 over a 2 staged process**

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Team

Client:	Western Sydney University
Architect:	dwp|suters
MEP & Environmental Engineer :	Umow Lai
Heritage Consultant:	Dawbin Architects Pty Ltd
Archaeology:	AMAC Pty Ltd
Laboratory Consultant:	AMEC Australia Pty Ltd / Norman Disney & Young
Structural / Civil Engineer:	Cardno (Sydney)
MEP & Environmental Engineer :	Umow Lai
Landscape:	Ray Fuggle & Associates
BCA:	Design Confidence
Quantity Surveyor:	RLB
Contractor:	AW Edwards

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Proposed Site
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Challenges & Opportunities

Understanding the Site

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Heritage

- **Heritage significance listed on**
  - State Heritage Register
  - Register of the National Estate
- **History**
  - 1813-1850 Female Orphan School
  - 1850-1887 Protestant Orphan School
  - 1887-1987 Rydalmere Psychiatric Hospital
- **Archaeology**
  - high archaeological research potential with state significance
  - Aboriginal consultation & test excavations were undertaken
  - Aboriginal Heritage Impact Permit was required

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Heritage significant
Vernon Lawn precinct
Archaeological restrictions
Major Gas & Oil line
Car park
Rail Line
Challenges
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Opportunities

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Original Brief Design

Concept Design Framework

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The Challenges

- Elevate profile of Sciences at WSU
- Heritage & archaeological sensitive site
- Complex teaching & research facilities
- AMCF Highly Sensitive Equipment – vibration & electrical isolation
- Heavily serviced building
- Site constrained by major service lines
- Formal GBCA 5 Star Green Star rated laboratory facility
- Limited power supply on campus
- Non-briefed facilities added to project post engagement

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Approach

Functionality & Design

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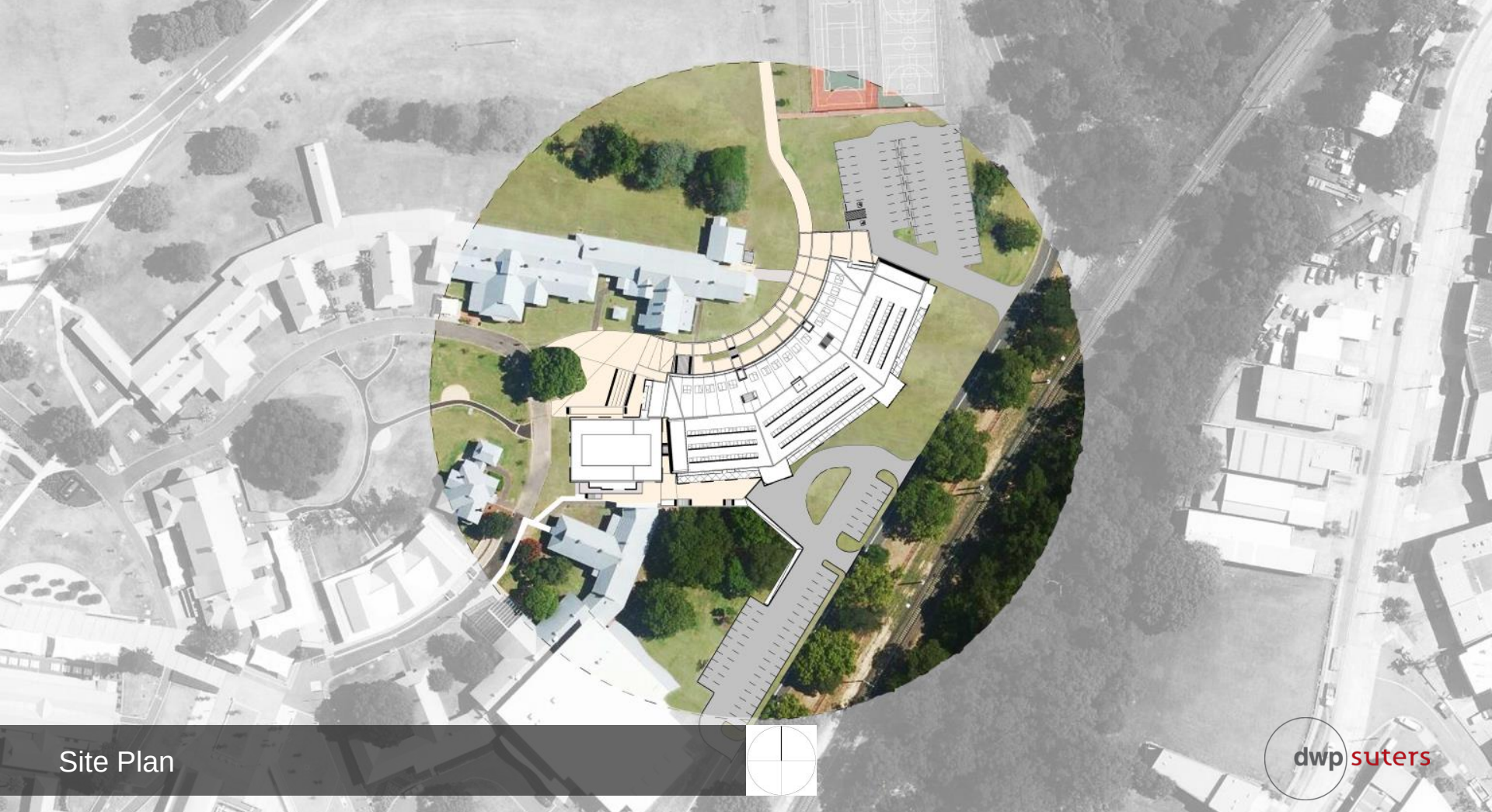

Site Plan

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First Floor

Research Labs

1. Offices
2. Collaboration zone
3. Biological chemistry + micro biological lab
4. Instrumentation room
5. Chemistry synthesis lab
6. Amenities
7. Post-doctoral offices
8. Research students
9. Spare lab space (currently being fitted out)
10. Gantry – services zone

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Ground Floor

Teaching Labs

1. Main entry lobby
2. AMCF
3. Offices
4. Collaboration zone
5. Physical sciences lab.
6. Chemistry lab. prep
7. Chemistry lab.
8. Instrumentation room
9. Amenities
10. Biological sciences lab.
11. Biological sciences prep
12. Micro bio. Lab
13. Advanced simulation lab.
14. Gantry – services zone

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social science & psychology

1. Collaborative zone
2. Seminar rooms
3. Research labs
4. Amenities
5. Art
6. Stores
7. Plant
8. Gantry – services zone
9. Loading dock
10. Gas stores

Lower Ground Floor

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Cross Section

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Aerial

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Eastern Facade

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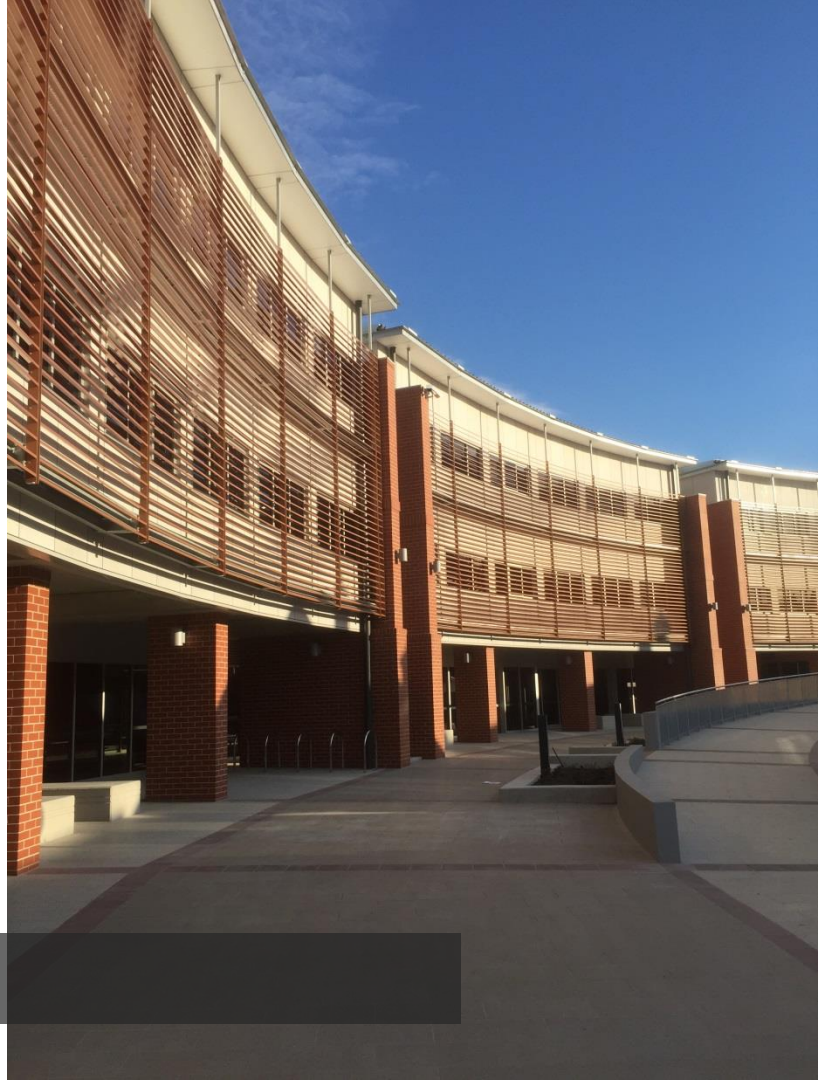

Northern Facade

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Northern facade

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Main Entry

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Collaborative Circulation Spine

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Collaborative Circulation Spine (1st)

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Teaching Laboratory

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Research Laboratory

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Sustainability

Green Star Initiative

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Green Target

- Design team elevated target to 6 Star Green Star – GBCA Green Star (Education Design v1)
- Limited campus electrical capacity, only 300kW of power available to building
- Low energy lab facility proposed
- Existing central campus plant
- Rigorous process to achieve 6 Stars

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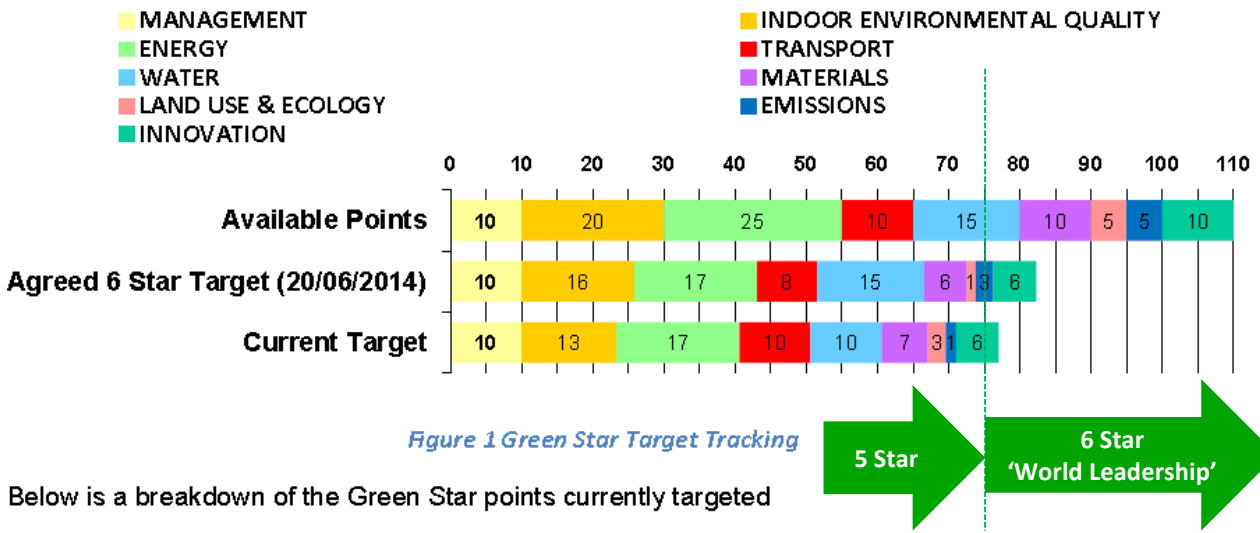

Figure 1 Green Star Target Tracking

Green Target

Below is a breakdown of the Green Star points currently targeted

Category	Points Available	Weighted
Management	10	10
Indoor Environment Quality	20	13
Energy	25	17
Transport Water	10	10
Water	15	10
Materials	10	7
Land Use & Ecology	5	3
Emissions	5	1
Innovation	10	6
Total	**110**	**77**

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Solar Roof

- 100kW photovoltaic array
- Gas boosted solar hot water

Gantry – Mechanical Plant

- HVAC system linked to central plant
- High efficiency dehumidification air handling units – delivering 100% fresh air
- Efficient HVAC pumps & chillers
- BMS energy consumption monitoring

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Lab Spaces

- Fabric ducts to lab spaces
  - Reduces dust
  - washed clean
- LED lighting
- Activated thermal mass – exposed concrete soffits
- In-slab hydronic cooling & heating system

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Indoor Environment – Summer Condition

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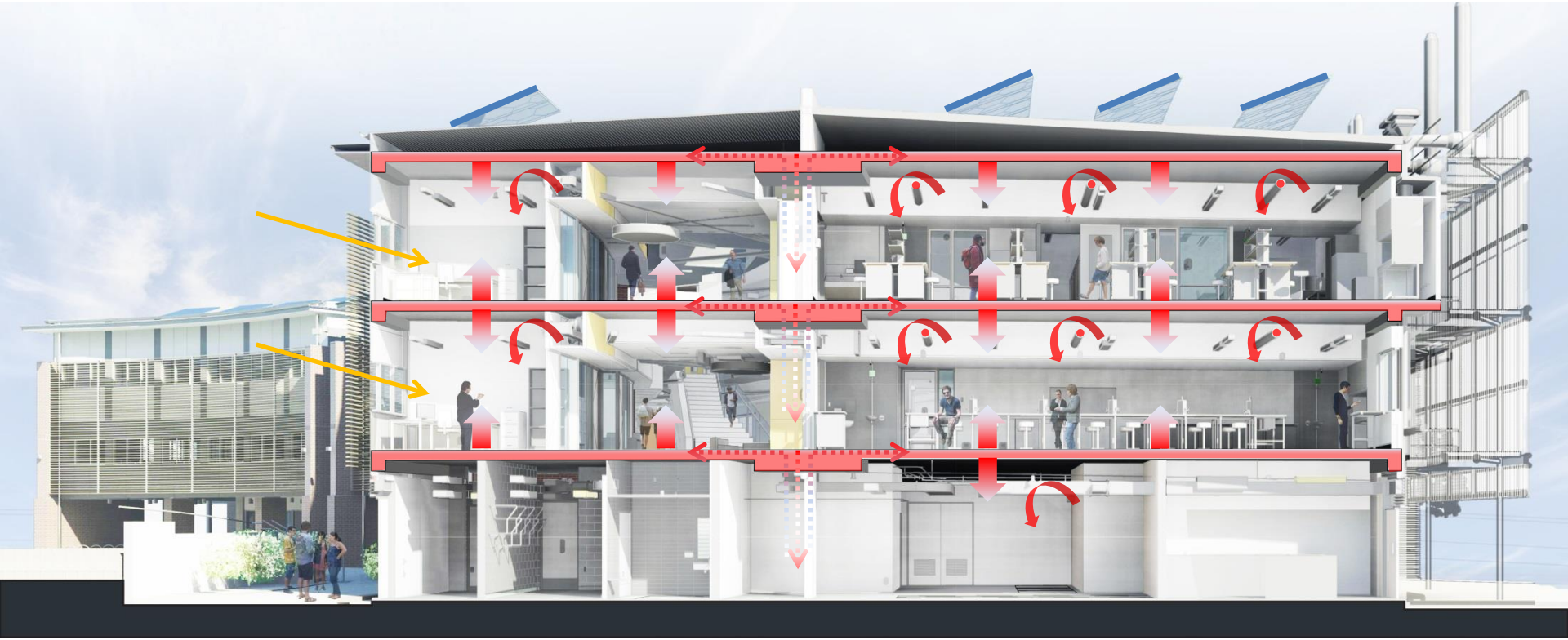

Indoor Environment – Winter Condition

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Complex Services

- Laboratory gases - 17 different types gases
- Potable and non-potable water
- Single and 3 phase power
- Vacuum, Instrumentation & Compressed Air systems
- AMCF equipment highly sensitive to vibration & electrical interference
  - AMCF located furthest away from train line
  - 400mm deep independent structural slabs on deep piles
  - Stainless steel slab reinforcement
  - Lift isolation
  - Shielding against high voltage lines, fuel & gas lines

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Gantry – Services Zone

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Gantry – Services Zone

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Gantry – Services Zone

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Gantry – Services Zone

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Other Green Initiatives

- Chain of custody for sustainably sourced materials
- Eco Concrete (proportion of recycled concrete)
- Sustainable structural system
- Furniture and equipment with certified sustainable properties

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Innovation

A Transformative Process

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Value Engineering Process

- 8 week intensive value engineering process
- $2.4m of savings offered during tender period (9% of contract sum)
- $1.8m savings realised as a result of VE process
- Conscious decision to maintain 6 Green Star target

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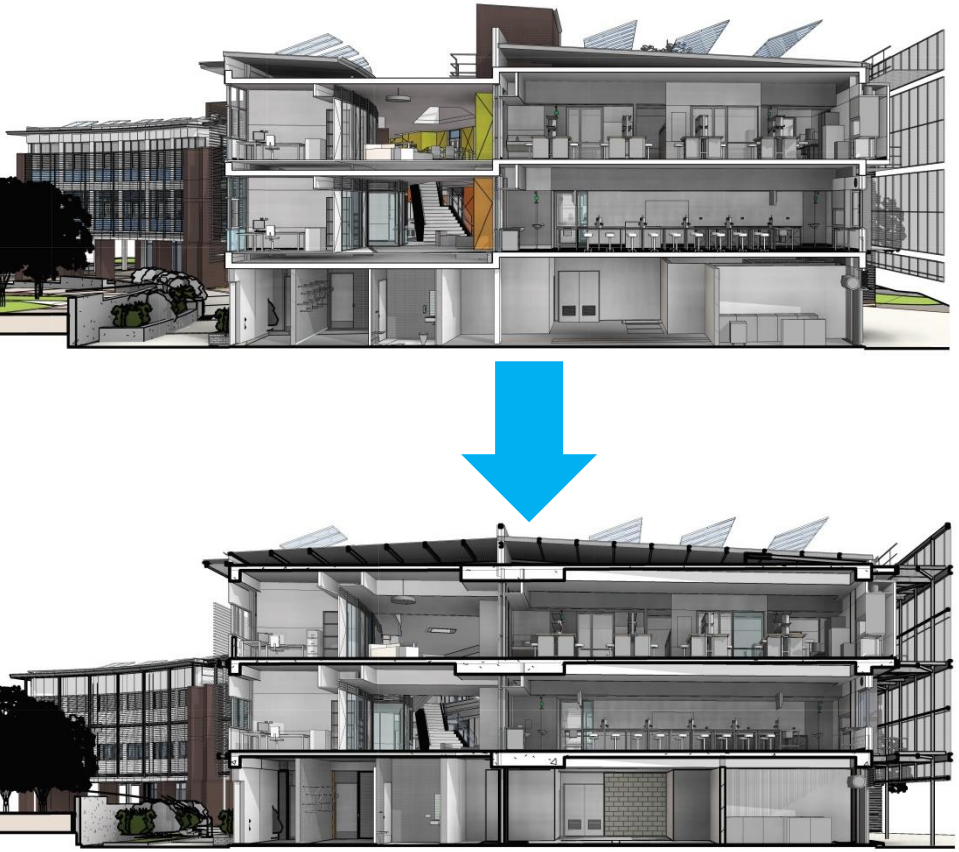

- In-ground stormwater retention tank in lieu of above ground bio retention basin
- Stepped slab & raised access floor removed & post tensioned continuous slabs introduced
- Lower ground floor hydronic system removed
- Re-designed services distribution & reticulation
- Revised ceilings and re-defined extent of off form concrete
- Revised roof and supporting steel structure
- Reduction and simplification of internal finishes
- External terrace enclosed (future expansion space)
- Retaining walls & landscaping reduced
- North façade fixed glazing replaced with CFC cladding

Value Engineering Process

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Construction Innovation

- Architect on site 1 to 2 days per week – reduced RFI's by up to 80%
- Exposed off form concrete:
  - Contractor developed 200 page concrete management plan
  - Galvanised mesh & no snipping of excess tie wire to avoid rust stains
  - Formwork used only once on each side
  - Low wastage on formwork
  - Detailed formwork set out aligning vertical and horizontal joints
  - Detail set out of in-slab services and outlets (resulting in only 1 additional penetration)
- Removal & Disposal of contaminated spoil $2m –Triangular Irregular Network (TIN) file utilised to develop accurate bulk levels. Result cost was within 3% of contractor's forecast

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Lower Ground Floor Slab

- Cupolex void formwork
- Made from recycled car batteries
- Trench mesh replaces heavy reinforcement
- Cupolex 20% more expensive but saved on concrete, reinforcement & excavation

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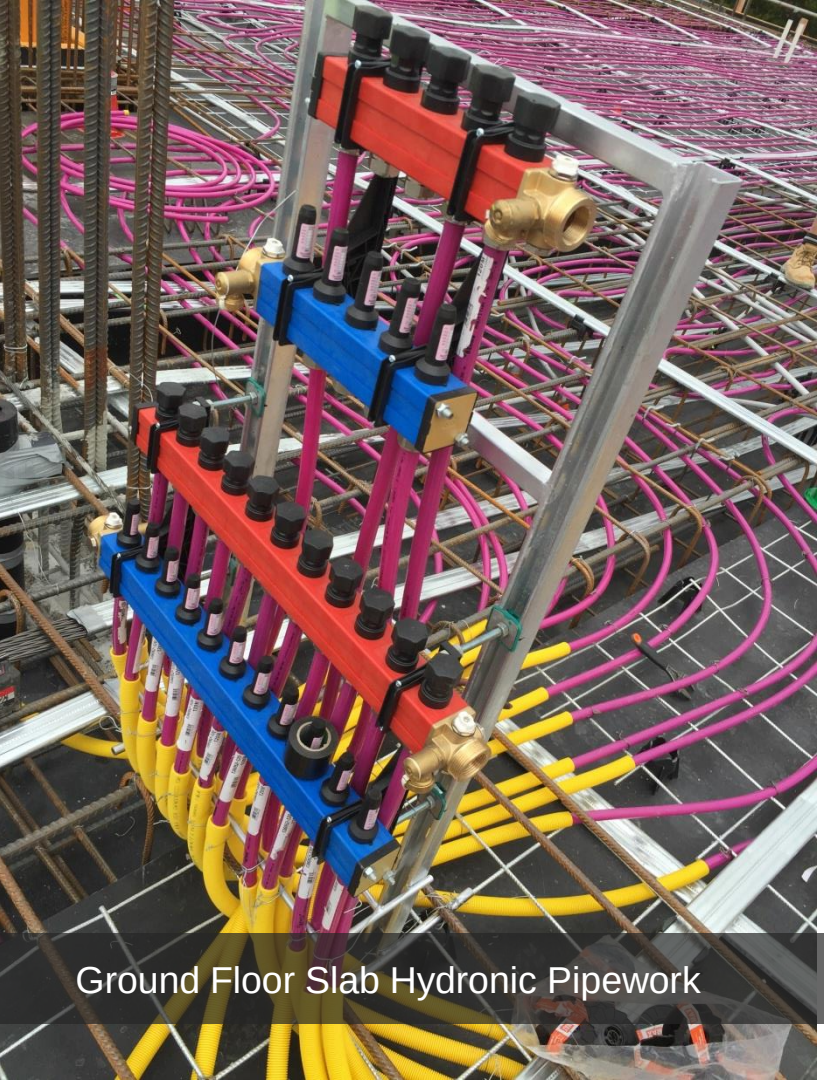

Ground Floor Slab Hydronic Pipework

- Hydronic system is a closed loop system, reticulating pressurised filtered hot or cold water at regulated temperatures depending on season
- REHAU hydronic system: provided an unconditional warranty
- 22kms of hydronic pipework laid
- System designed without joints
- Pressure tested prior to concrete pour, only one leak found & repaired across entire project.

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Ground Floor Slab Hydronic Pipework

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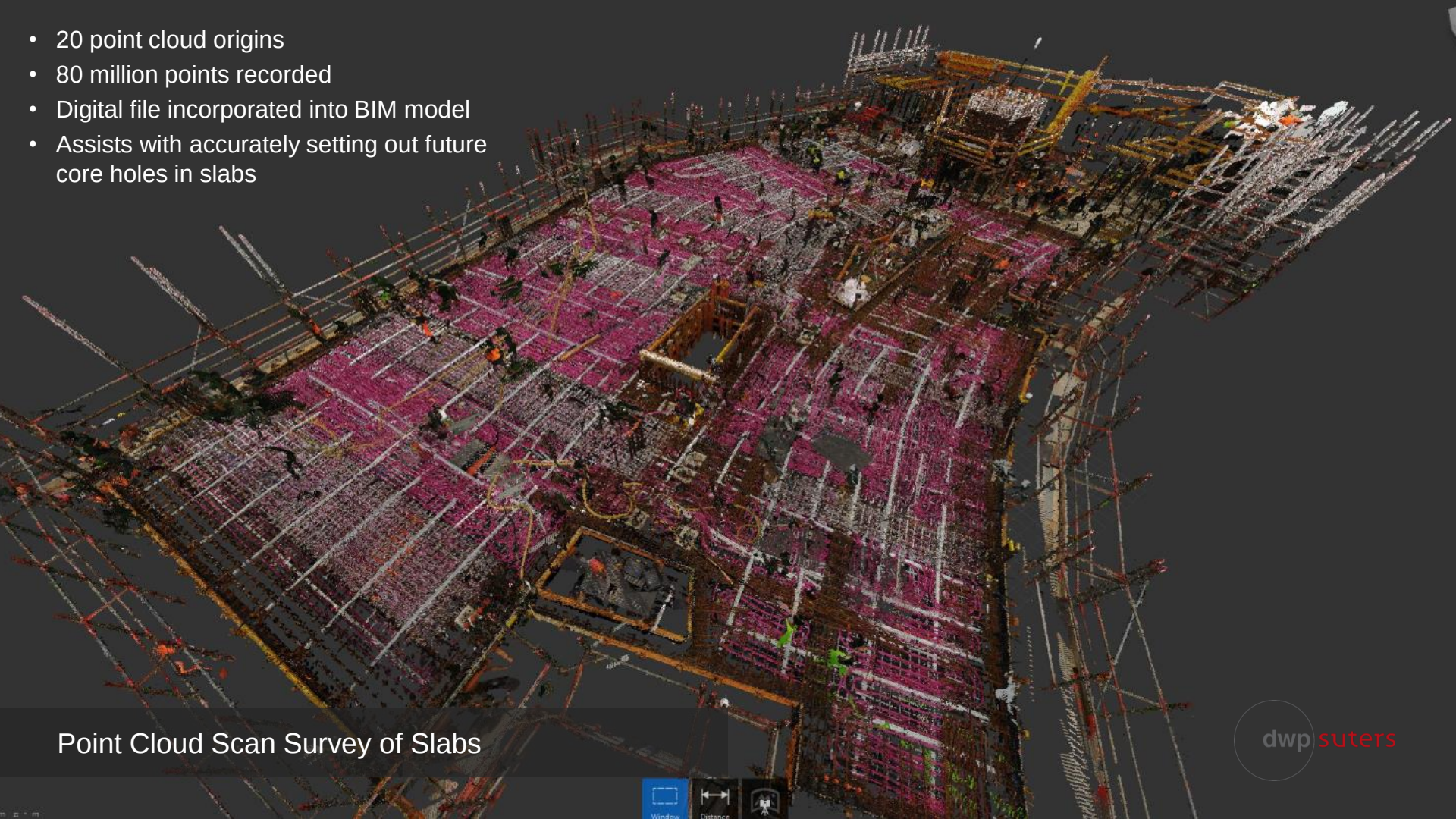
- 20 point cloud origins
- 80 million points recorded
- Digital file incorporated into BIM model
- Assists with accurately setting out future core holes in slabs



Point Cloud Scan Survey of Slabs

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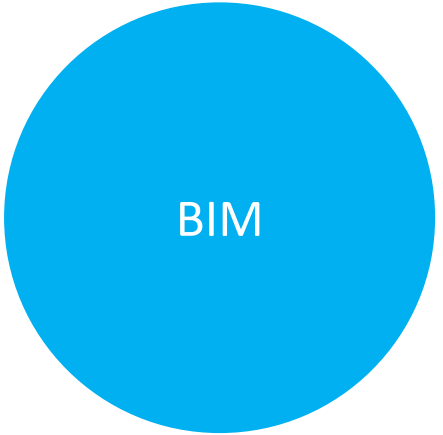

- BIM model developed to LOD 300
- Used for clash detection
- BIM further developed during construction assisting:
  - Trades with clash detection and coordination
  - Cost saving measures
  - Better engagement with subcontractors, explaining design and work methods
  - Pricing purposes by utilising snap shots of model
  - Point cloud scanning for as built drawings, particularly for hydronic pipework
  - Stream lining materials & methods of construction
  - Work as constructed checked against the model at each stage
  - Checking work in progress against Green Star credits

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Outcomes

- VE process highlighted advantages of early contractor involvement. Could have occurred sooner, at 50% Documentation Stage?
- Efficiency of the site architect,1-2 days per week minimum
- Importance of collaborative relationships
- Collective buy-in to Green Star targets defined upfront and maintained throughout

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Converting challenges to opportunities

- Profile of Science at WSU has been lifted
- Maximised utilisation of space
- Commissioning results of sensitive equipment exceed expectations
- Simple, controlled management of highly complex building services
- Outstanding GBCA 6 Star Green Star rating
- Efficient design of outstanding systems

Outcome exceeded original project brief whilst remaining on budget

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Thank You

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