

Umow Lai

Building Services and Sustainability Consultants



Green Laboratories

Lynette Williams

Umow Lai

Our Company



Dominic Lai



George Umow

- Building Services Consultancy
- Started in 1991
- Specialising in University, Schools, Laboratories and Hospitals
- Emphasis on Green building design and innovation
- Offices in Sydney, Melbourne and Brisbane, with 120 staff
- Projects throughout Australia, also New Zealand, China and Hong Kong



Outline



- What is a **Green** building?
- What matters in **Green** Laboratories?
- Trends in Laboratory design
- Case Studies

Good design applies equally to a laboratory building:

- Orientation
- Efficient facade
- Natural daylighting
- Efficient lighting
- Efficient air conditioning
- Heat recovery
- Rainwater collection and reuse



What else matters in **Green** Laboratories?

- Outside air matched to use
- Reduce Fume Cupboard Energy use
- Eliminate simultaneous heating and cooling
- Scrutinize equipment load estimates
- Use water wisely
- Inform occupants of energy issues



Trends in Lab Design



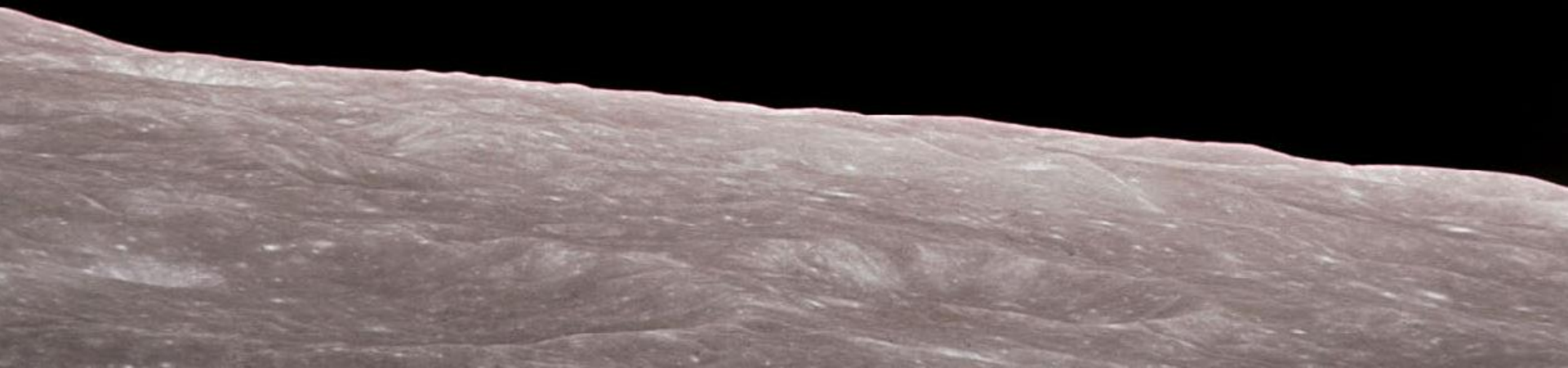
- Flexibility – allow for the layout to change
- Design for technology
- More team based research with shared equipment
- **SUSTAINABLE...**



Challenging Thoughts



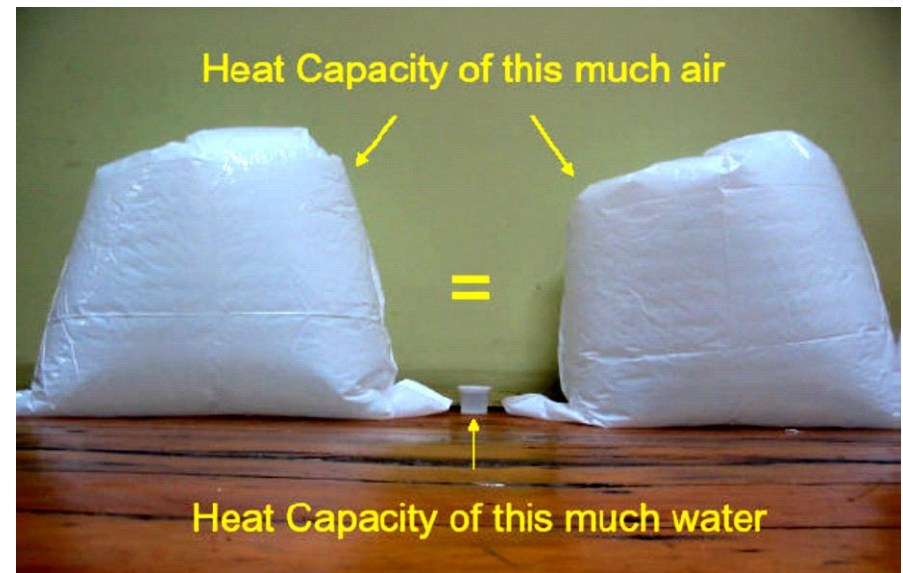
“Energy efficient laboratories helps move money to the mission of the organisation from ongoing running costs.”



Umow Lai's Approach



- Determine the requirements of the space (Compliance)
- Distribute water rather than air
- Aim for solutions which relate to occupant comfort
- Building specific solutions





Case Studies

2003-2009 The John Curtin School of Medical Research The Australian National University



Location: Canberra

Building description:

Three Storey building with three wings.

Area: 20,000m²

Building purpose: Post Graduate Research with Public foyer, lecture theatre and café



Completion:

Stage 1 - 2006

Stage 2 - 2009

Stage 3 - 2012

Architect: Lyons

Green Features



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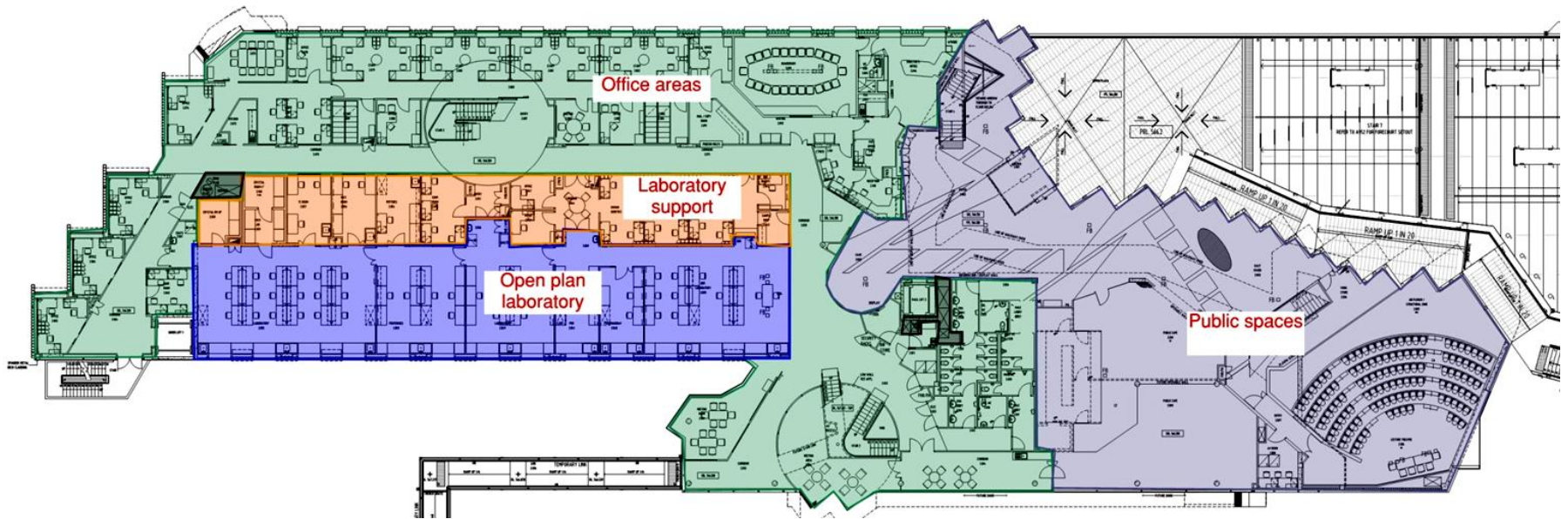
- Central tempered OA AHUs, local fan coil units
- Thermal labyrinth to pre-treat OA
- Mixed mode air conditioning to offices
- Thermal chimneys for relief
- Exhaust heat recovery
- Lighting controls
- Rainwater tanks for toilet flushing



Stage 1 Floor Plan



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Office areas

Laboratory support

Open plan laboratory

Public spaces

2005-2006 Monash Strip 2



Location: Clayton, Victoria

Building description:

2 linked 4 storey
laboratory/office buildings

Area: 17,250m²

Building purpose: Post
Graduate Research –
Faculty of Medicine,
Nursing and Health
Sciences



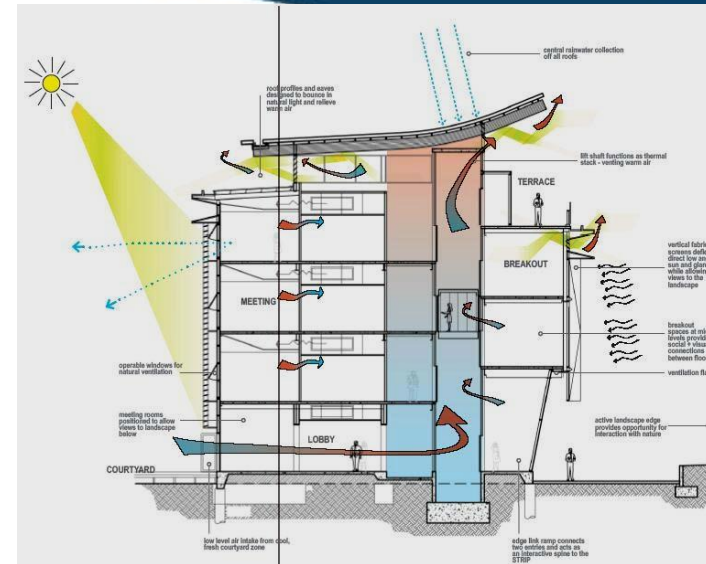
Architect: DesignInc

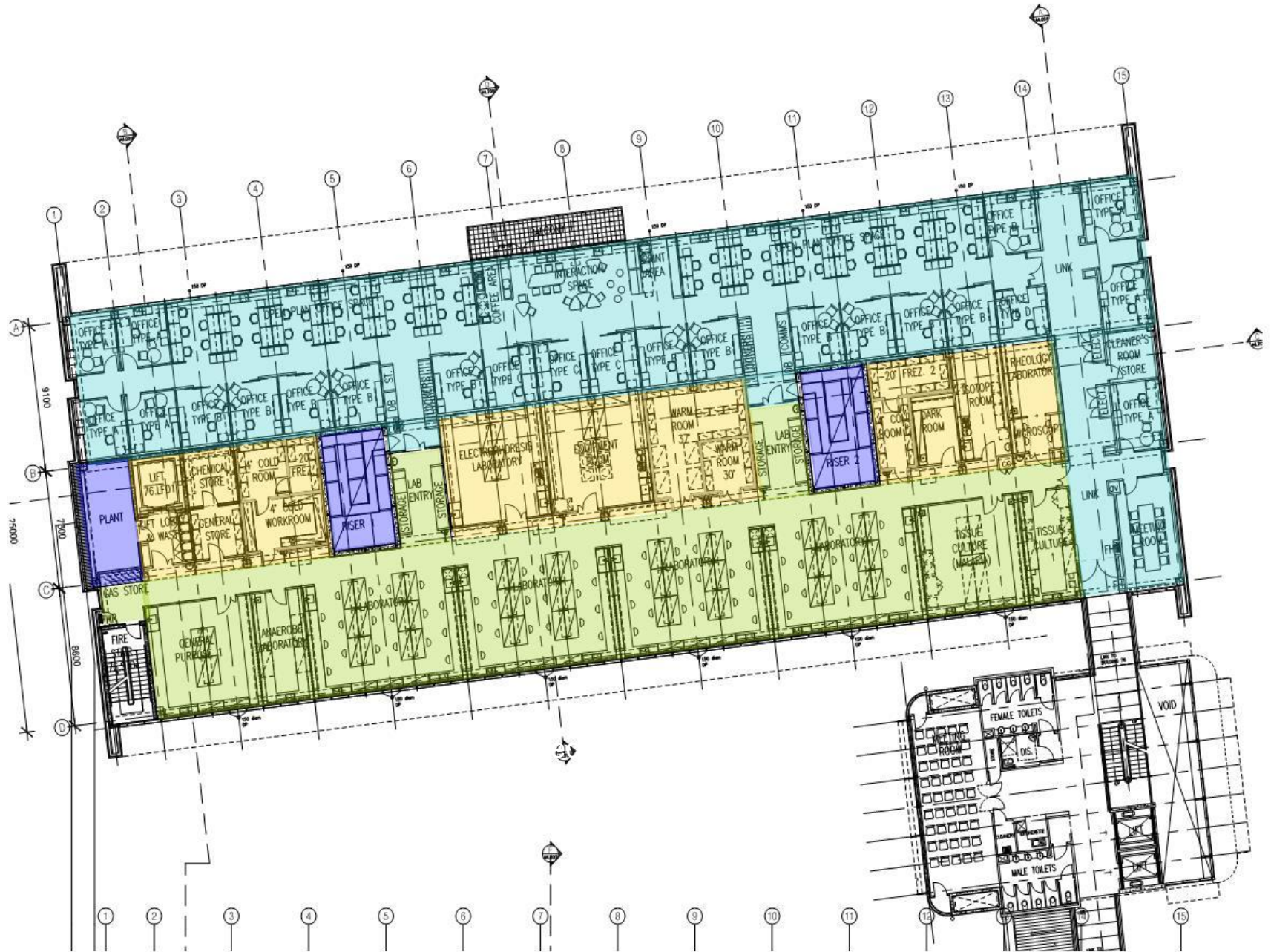
Green Features



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- High performance façade with shading
- Openable windows in offices
- Active mass cooling
- Under Floor Air Distribution to offices
- 100% outdoor air
- “Free cooling” cycle via cooling towers
- Exhaust air heat recovery
- Active Lighting control
- Rainwater harvesting and reuse





2008-2009 University of Adelaide, Ingkarni Wardli



Location: Adelaide

Building description: Eight Storey building

Area: 14,497m²

Purpose:

Engineering/computer laboratories

6-star Green Star Education v1 Design and As-built ratings



Client: University of Adelaide
Architect: DesignInc

Green Features

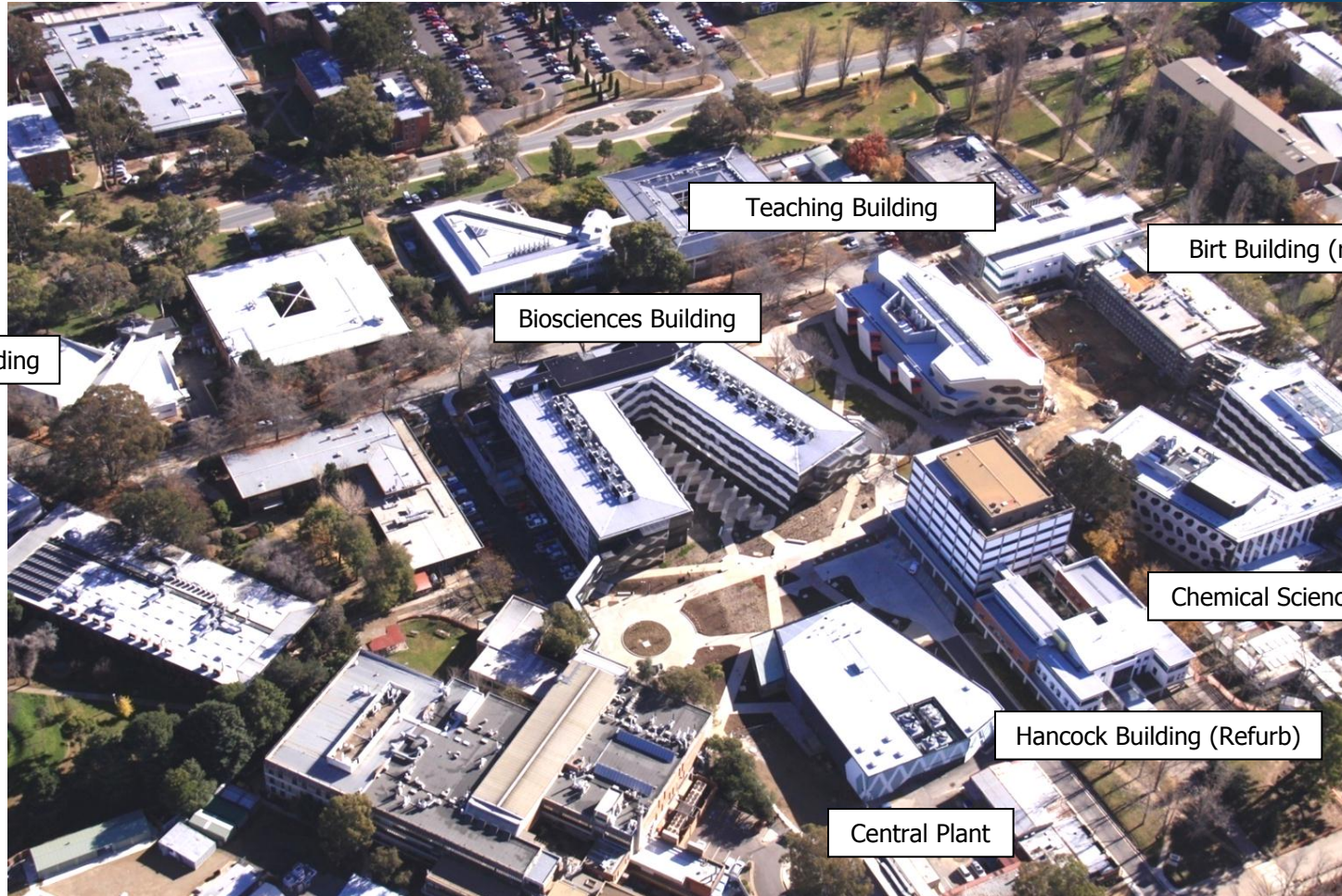


- UFAD with 100% fresh air
- Thermal Chimneys
- BATISO hydronic slab cooling and heating
- Geothermal system
- Gas fired cogeneration
- Rainwater system for toilet flushing and irrigation
- High performance façade with shading

2008-09 ANU Colleges of Science



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Architect: Lyons

Green Features



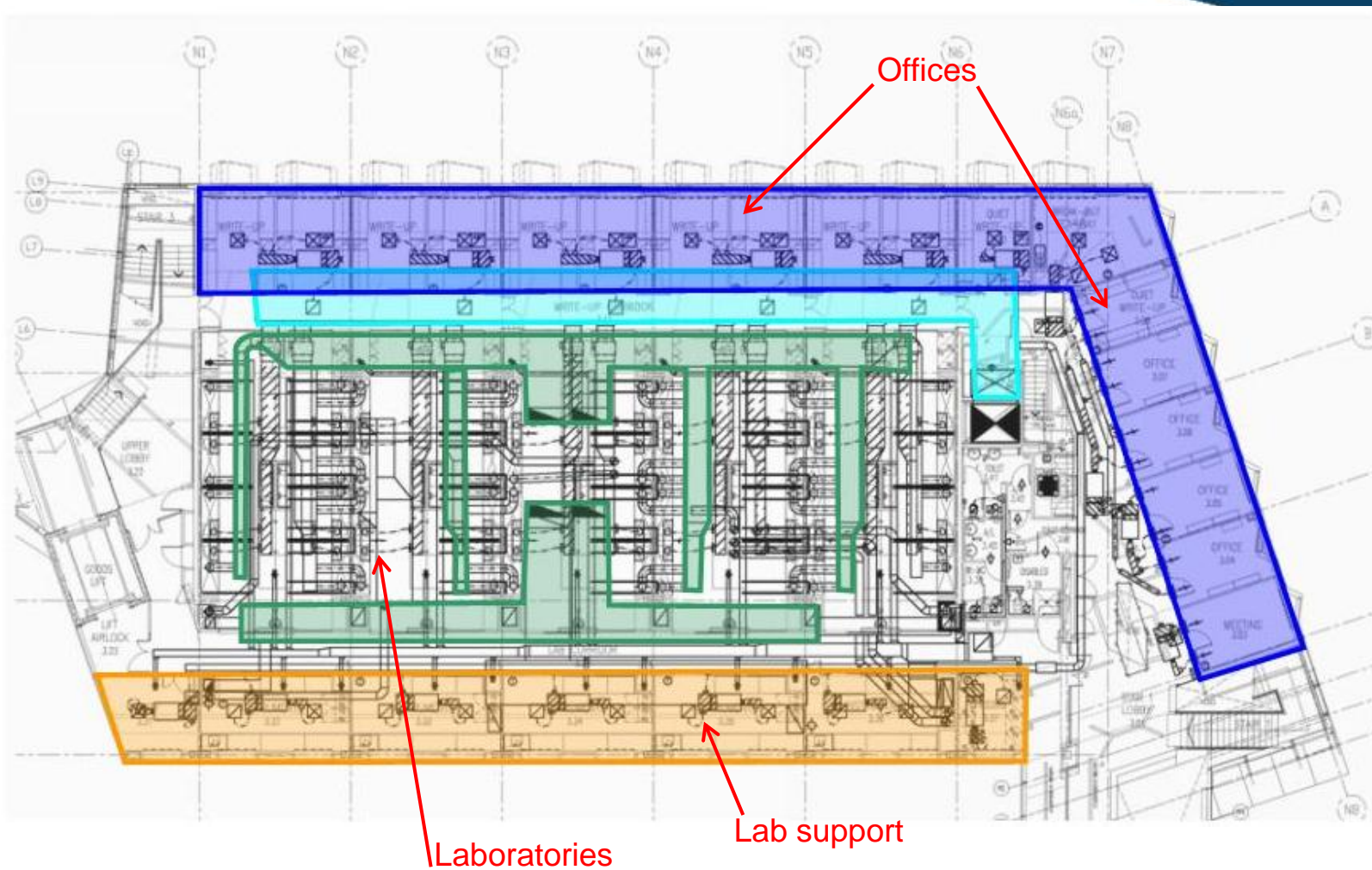
- Central plant – Chillers, Cooling towers, Condensing boilers
- Manifolded Fume Cupboards.
- Dedicated laboratory equipment cooling.



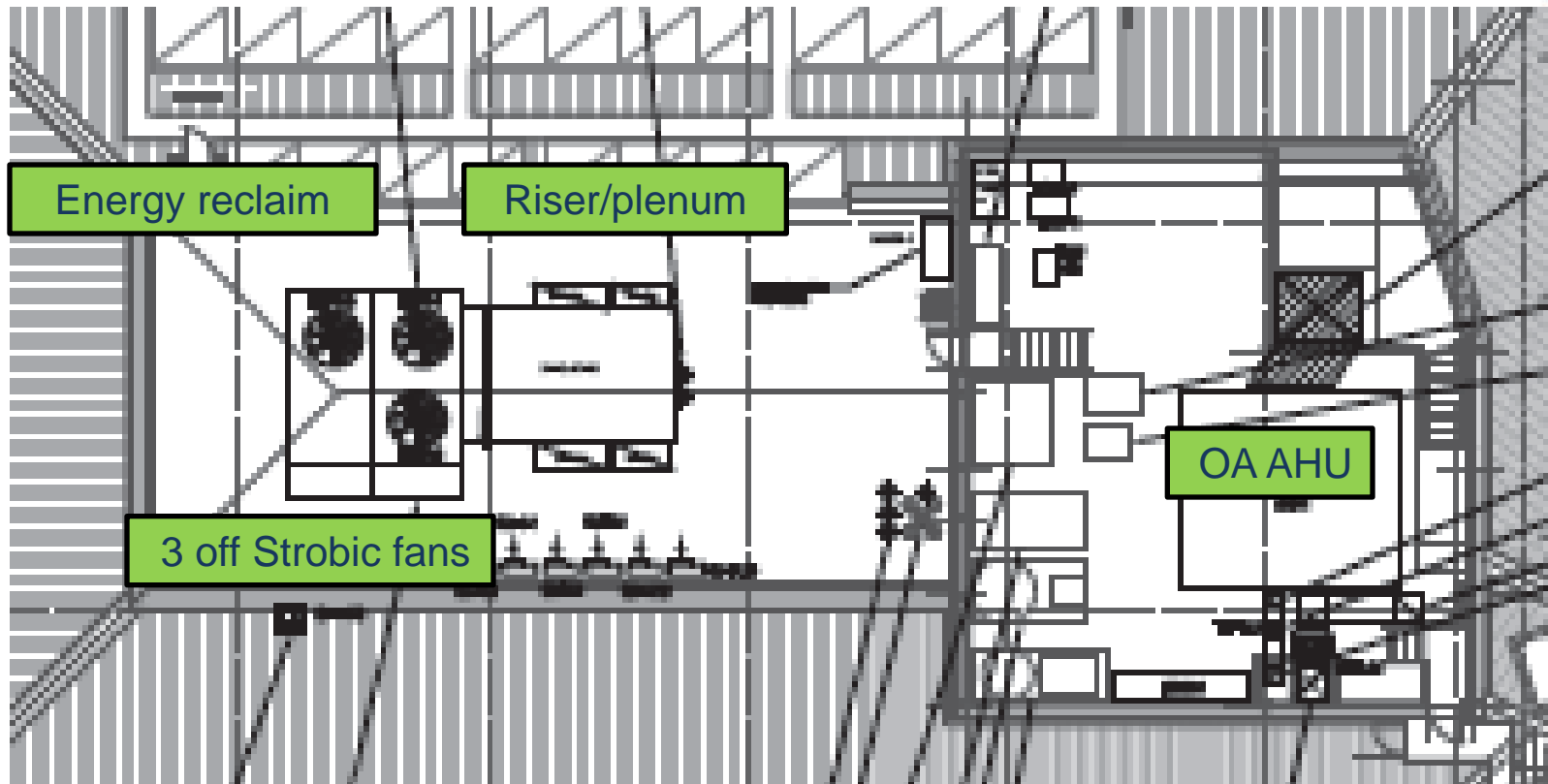
COS Chemistry Building



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Manifold Fume Cupboards - Roof



CoS Teaching Building



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44 manifolded fume cupboards, with heat recovery



2009 New Horizons, Monash University



Location: Clayton, Victoria

Building description: 5 Levels

Area: 20,000m²

Purpose: Joint venture between Monash University and CSIRO.

Research with PC2 laboratories, offices and Collaboration Lounge at Level 5

6-Star GreenStar Education v1 Design and As-built



Architect: Lyons

Green Features



- Active mass
- UFAD in the offices
- Sock diffusers in the laboratories
- Dedicated equipment cooling system
- Co-generation system - 1000kW, 30% predicted peak load



2010 CSU- National Life Science Hub



Location: Wagga Wagga

Building description:

Single floor with
basement and roof plant
areas

Area: 4,000m²

Purpose: Undergraduate
teaching and research
with PC2 and QC2 areas

5-Star GreenStar
Education v1 Design



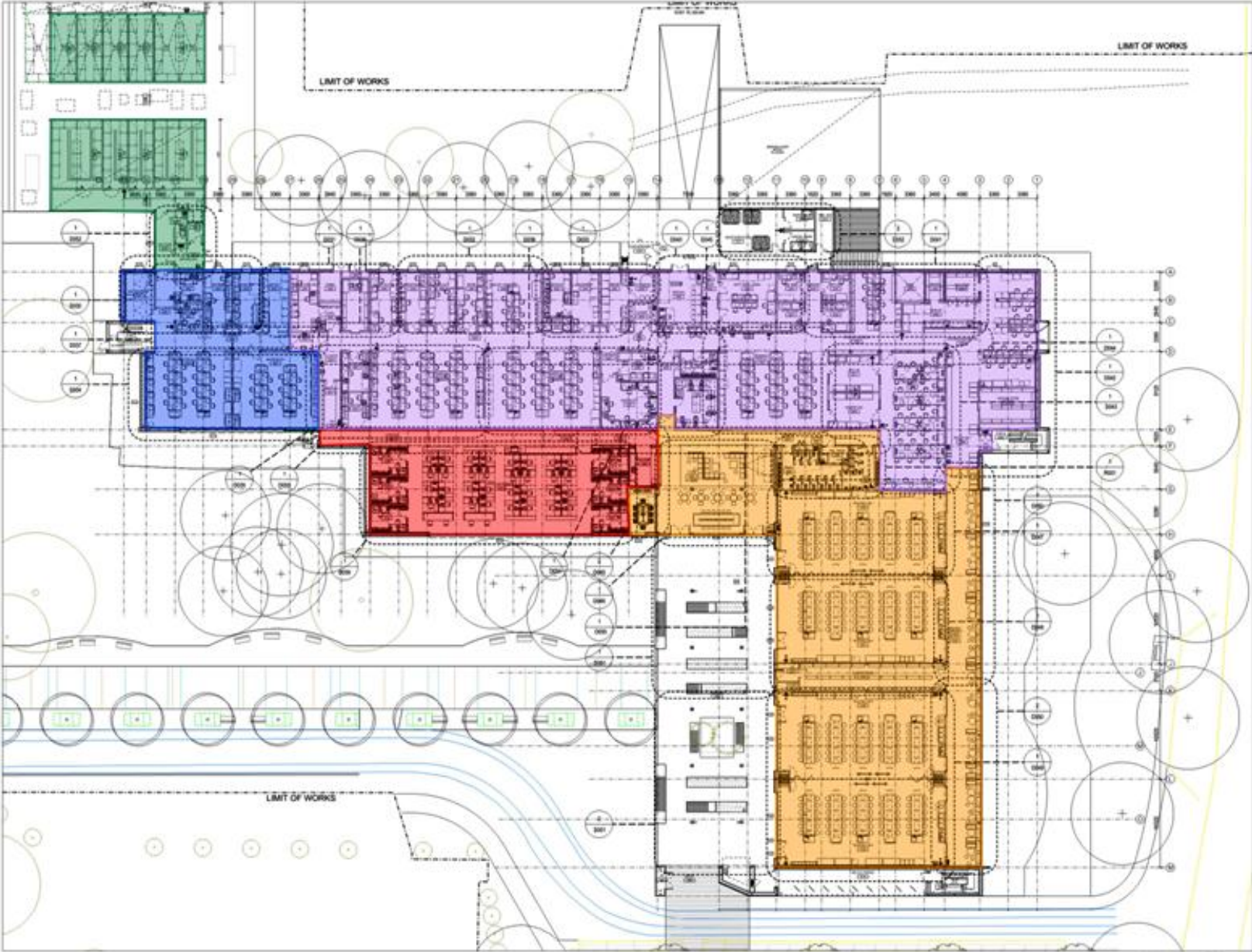
Client: Charles Sturt University
Architect: BVN

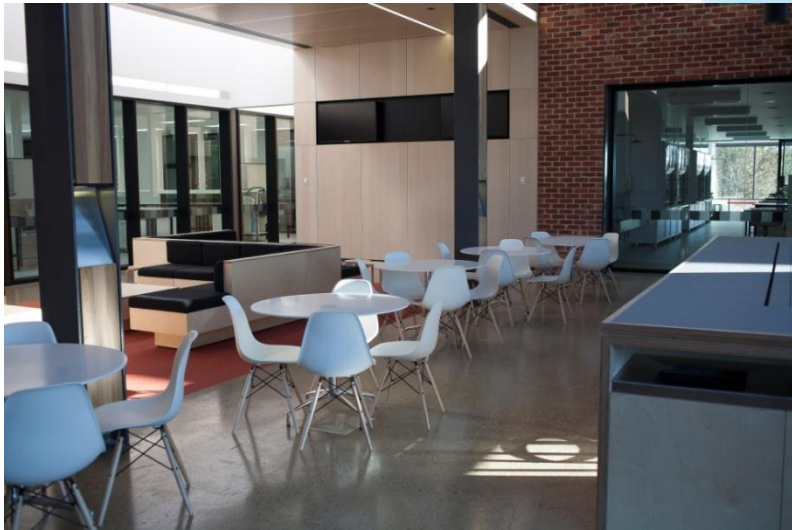
Green Features



- Rain water reuse
- Energy Efficient Power Pax chillers with Evaporative Pads
- Condensing Heating Hot Water Units
- Indirect Evap cooling on outside air
- LCD screens







2011 University of Tasmania, Medical Science (MS2)



Location: Hobart, TAS

Building description:

Six storey building

Area: 7,000m²

Purpose: Joint facility for
University of Tasmania,
Faculty of Health Science
and Menzies Research
Institute

5-Star GreenStar
Education v1 Design rating



Photo Courtesy of: University of Tasmania

Architects: Lyons

Green Features



- 80,000-litre rainwater harvesting tank, serving toilets
- Heat recovery run-around coils in the ventilation system
- High efficiency variable refrigerant flow air conditioning system
- Solar hot water
- Energy-efficient lighting units with proximity sensor activation
- Daylight glare controls – external sunshades, highly-efficient glass and user-controlled blinds to all office/ lab environments.

2011 Institute of Marine & Antarctic Studies



Location: Hobart, TAS

Building description:

Three storey building

Purpose: PC2/QC2

laboratories and
supporting dry labs and

offices as well as a

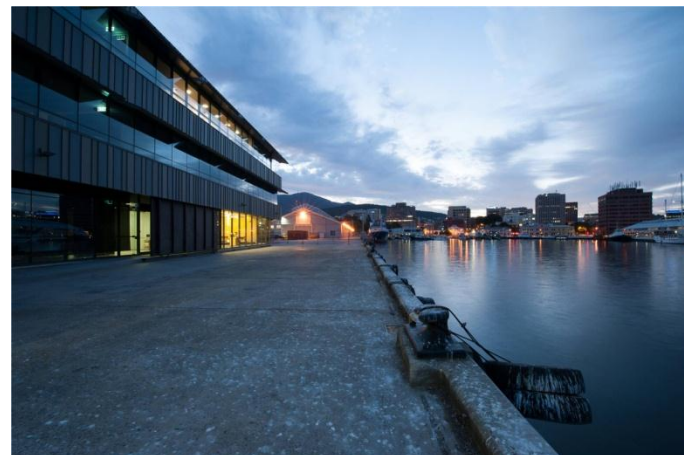
lecture theatre and

teaching laboratories

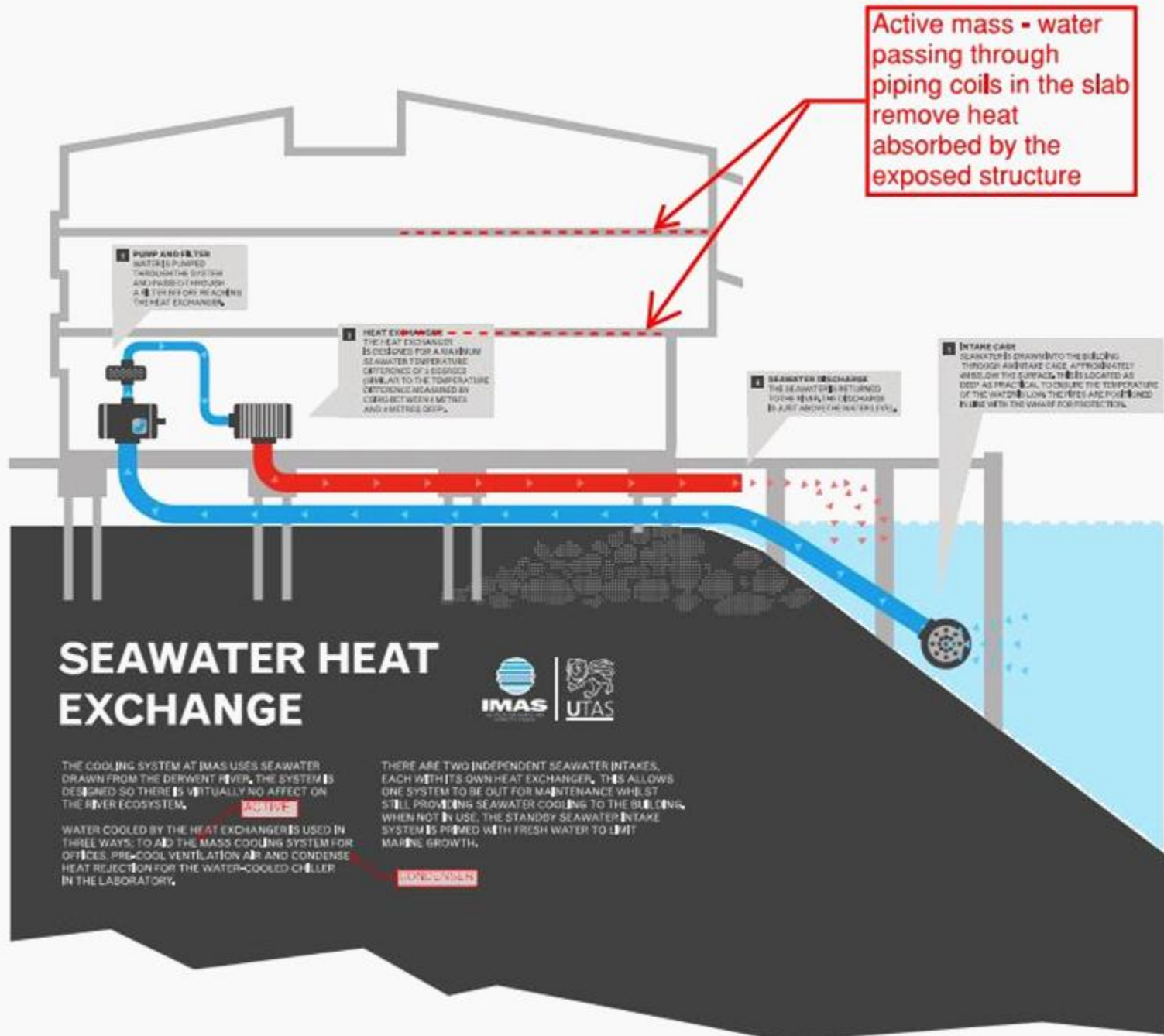
5 Star GreenStar

Education v1 Design

rating



Architects: John Wardle Architects



Active mass - water passing through piping coils in the slab remove heat absorbed by the exposed structure

1 PUMP AND FILTER
WATER IS PUMPED THROUGH THE SYSTEM AND PASSED THROUGH A FILTER BEFORE REACHING THE HEAT EXCHANGER.

2 HEAT EXCHANGER
THE HEAT EXCHANGER IS DESIGNED FOR A MAXIMUM SEAWATER TEMPERATURE DIFFERENCE OF 3 DEGREES (SIMILAR TO THE TEMPERATURE DIFFERENCE MEASURED BY COILS BETWEEN 1 METRE AND 4 METRES DEEP).

4 SEAWATER DISCHARGE
THE SEAWATER IS RETURNED TO THE RIVER WITH A TEMPERATURE IS JUST ABOVE THE WATER LEVEL.

3 INTAKE CAGE
SEAWATER IS DRAWN INTO THE BUILDING THROUGH AN INTAKE CAGE APPROPRIATELY SIZED. THE SURFACE TRAPS ARE LOCATED AS DEEP AS PRACTICAL TO ENSURE THE TEMPERATURE OF THE WATER BELOW THE TRAPS IS POSITIONED IN LINE WITH THE WAVE FOR PROTECTION.

SEAWATER HEAT EXCHANGE



THE COOLING SYSTEM AT IMAS USES SEAWATER DRAWN FROM THE DERWENT RIVER. THE SYSTEM IS DESIGNED SO THERE IS VIRTUALLY NO AFFECT ON THE RIVER ECOSYSTEM.

WATER COOLED BY THE HEAT EXCHANGER IS USED IN THREE WAYS: TO AID THE MASS COOLING SYSTEM FOR OFFICES, PRE-COOL VENTILATION AIR AND CONDENSE HEAT REJECTION FOR THE WATER-COOLED CHILLER IN THE LABORATORY.

THERE ARE TWO INDEPENDENT SEAWATER INTAKES, EACH WITH ITS OWN HEAT EXCHANGER. THIS ALLOWS ONE SYSTEM TO BE OUT FOR MAINTENANCE WHILE STILL PROVIDING SEAWATER COOLING TO THE BUILDING. WHEN NOT IN USE, THE STANDBY SEAWATER INTAKE SYSTEM IS PRIMED WITH FRESH WATER TO LIMIT MARINE GROWTH.

IMAS

UTAS

2014 University of Canterbury, Regional Science and Innovation Centre



Location: Christchurch,
NZ

Building description: 5
storey with Offices and
Laboratory

Area: 20,000m²

Purpose: Undergraduate
teaching, Post graduate
research.



Architects: Jasmax and DJRD



What's Next ?

- Acknowledge that Australian designs are world leading/cutting edge while continuing to review international trends.
- Continuing to provide project specific designs to suit users needs
- Continuing to challenging Industry norms by understanding the reasons behind them



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