

Sydney Fish Market

Reinventing an iconic
cultural landmark

Project
Sydney Fish Market

Location
Sydney, Australia

Client
Infrastructure New South Wales

Expertise
Structural, civil and marine
engineering, technical advice



It has been called Australia’s ‘home of seafood’ and operates as the cornerstone of the country’s seafood supply chain.

But beyond its importance for the fish trade, Sydney Fish Market is the city’s third most visited tourist attraction, after the Sydney

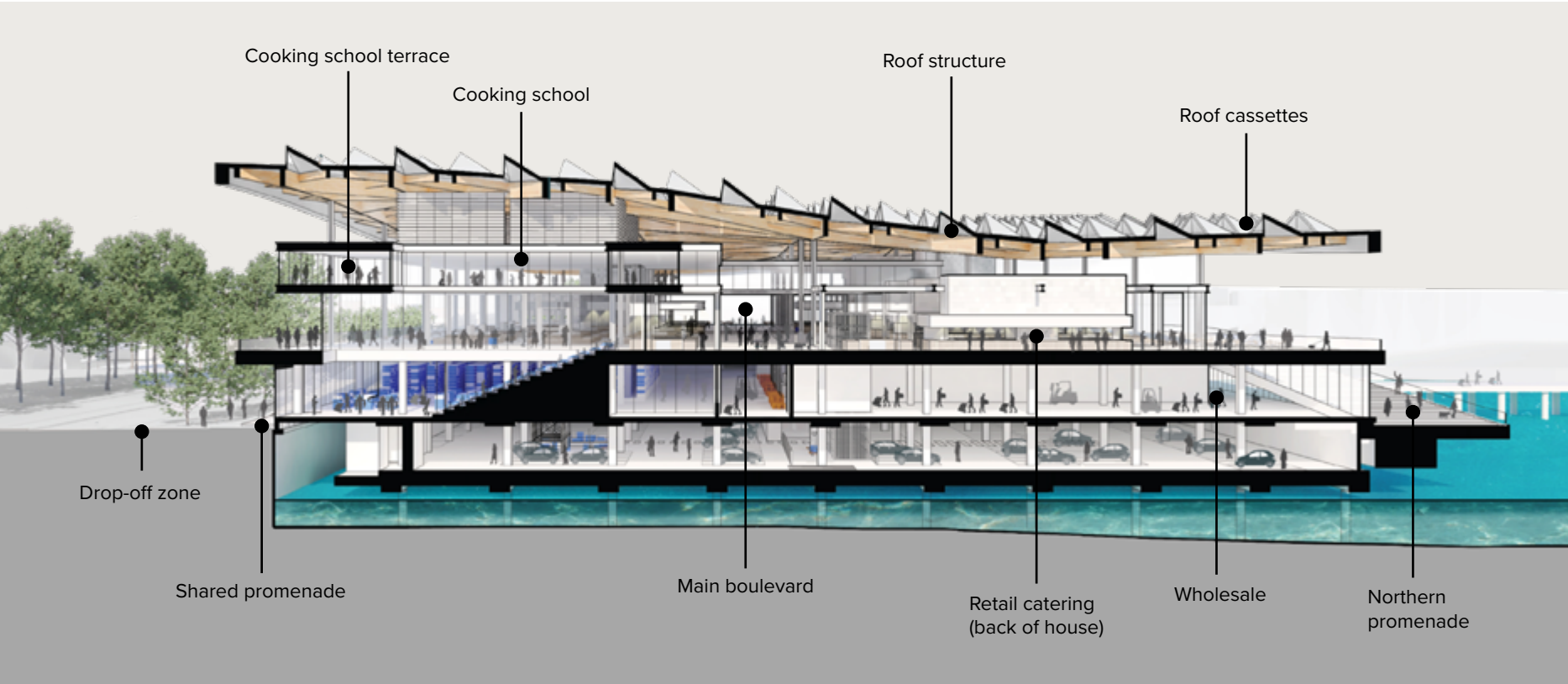
Opera House and Sydney Harbour Bridge, and is a vital part of the cultural and societal make-up of Australia’s most populous city.

Located in an adapted paper mill on the foreshore of Blackwattle Bay, Sydney Fish Market has been a New South Wales (NSW) institution since 1966. Despite drawing more than 2M visitors a year, criticisms have been raised over the site’s suitability as a tourist

destination, as while authentic, it is often congested, smelly, and not fit for purpose. In 2016, the NSW state government, through its delivery agency Urban Growth NSW and later Infrastructure NSW (INSW) announced redevelopment plans, with the goal of turning Sydney Fish Market into a world class attraction, and the catalyst for a multimillion-dollar revitalisation of the Blackwattle Bay precinct.

We helped INSW define what the new fish market could be and supported the tendering process. Following an international design competition, and from a shortlist of several notable architects, Danish firm 3XN in conjunction with local architects BVN put together the winning submission. We were the structural, civil and marine engineers for the three-year tender design phase and now sit client-side, assuring the design as technical advisor.

Front cover image credit: 3XN



Credit: 3XN



Finding the right location to meet everyone's needs

As the new building is the centre-point for the renewal of the entire Blackwattle Bay precinct, various design constraints, zoning laws, and location factors had to be considered. To achieve the desired revitalisation of the area and to make best use of existing transport links, the new facility is located close to the original market.

Suitable land owned by the government included nearby city parkland and the bay area stretching into the waters of Blackwattle Bay. Both areas had significant challenges. To avoid Sydney's parklands, the presence of heritage listed fig trees and significant contamination restraints, the bay was selected as the site of the new facility.

Locating the new building within the waters of the bay itself would require colossal excavation works, involving treatment of contaminated land, and be hugely expensive, with a temporary cofferdam wall built – costed at approximately AU\$1M per metre – to hold back the sea and keep the site dry during construction of the market. Matters were complicated further by Sydney Fish Market stakeholders requesting enhanced parking facilities at the new site, taking up a significant amount of space.

The existing Sydney Fish Market is located next to the site of the new development, in the Blackwattle Bay precinct of the city.



Supporting the new market just above the water line, but on the same plane as the surrounding ground would provide strong connectivity with the wider precinct, while removing the need for the cofferdam and significantly reducing the amount of contaminated ground requiring treatment.

We were instrumental in determining the best location, undertaking flooding assessments to determine the minimum ground floor level, and investigating the potential for using different construction methodologies, including design for manufacture and assembly (DfMA). Using DfMA to construct the new market's basement just above the water line enables elements to be manufactured offsite, making it easier and faster to assemble onsite and limiting disruption to the local community.

As part of our work, we also carried out in-depth stakeholder engagement to manage expectations for parking facilities and develop an understanding of customer and operational requirements. We defined a grid for the structure that provides a flexible space for operational and retail parking, as well as logistical and market operations, retail spaces and back-of-house activities. Our contributions were critical in ensuring the viability of the project, without which there was a significant risk it wouldn't go ahead.

Currently the market is a big tourist attraction, but its halls are often smelly, congested and unfit for purpose.



Delivering an authentic new fish market

Beyond the Sydney Fish Market organisation, INSW and other governmental stakeholders, the new fish market had to satisfy the numerous retailers and wholesalers that call the market home.



Credit: 3XN



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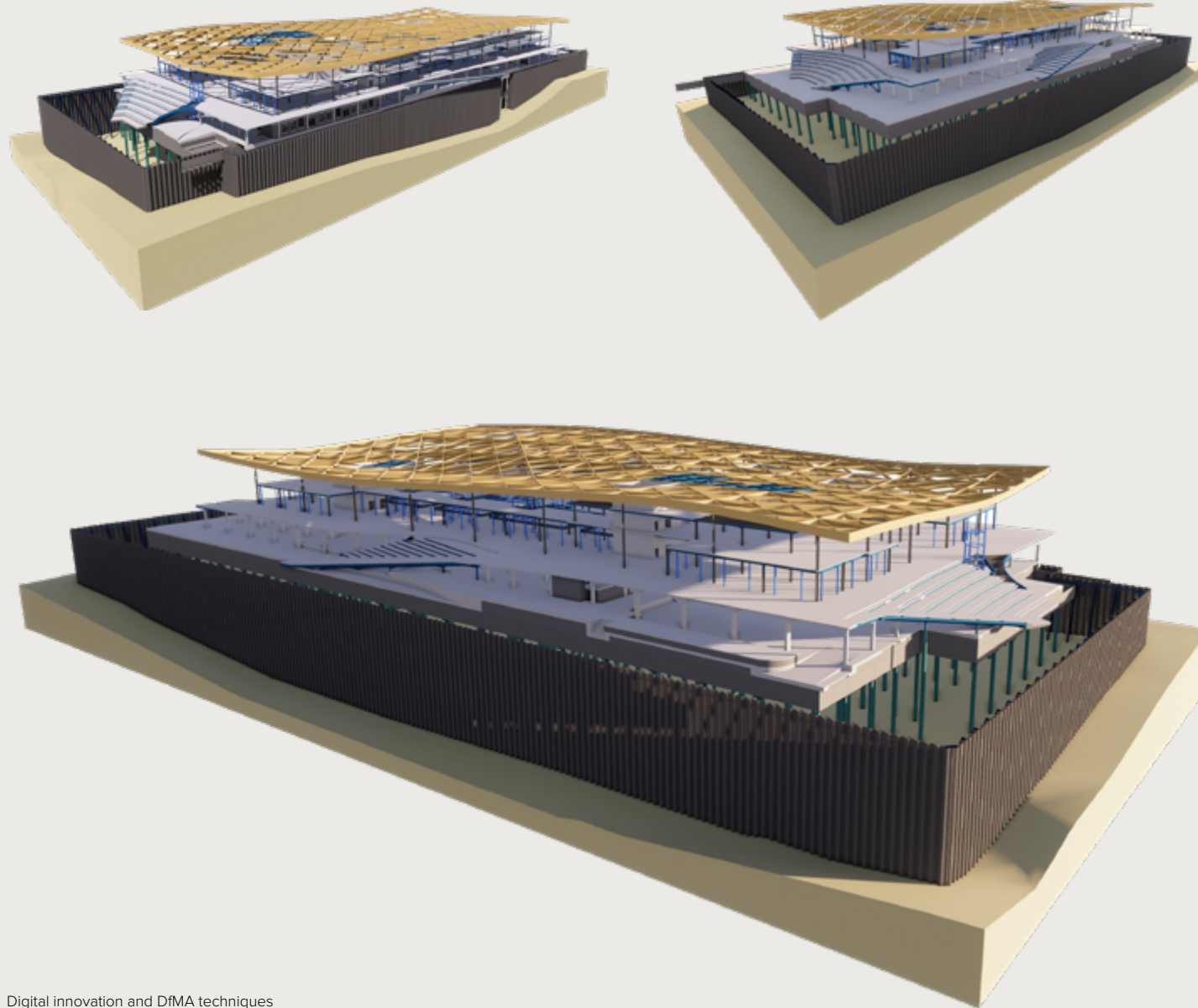
Without proper stakeholder management, the agitation of moving to a new site could appear to be a lot of pain relative to the gain.

We immersed ourselves in market operations, with early morning visits to observe and interact with the various stakeholders holding auctions, loading and unloading fishing vessels and trucks, and preparing and selling fish for wholesale and retail.

Mott MacDonald project director Graham Babcock says he was “initially taken aback by the organised chaos,” but recognised “the value in analysing and understanding these key operational functions.”

Detailed modelling of vehicle movements was undertaken to ensure heavy goods vehicles would be able to operate beneath the western promenade of the new building. This is possible due to long-span structures, which separate customer parking and loading zones. Auction operations in the old facility were behind closed doors, but the new market incorporates large voids in the floor plate of the retail floor, allowing visitors to watch the activity from the promenade.

“Safely enhancing the visiting public’s experience and interaction with the full product cycle was an ever-present design element,” says Graham. “Removal of the risk of HGV and forklift trucks from the vicinity of customers was a huge boost to safety.”



Digital innovation and DfMA techniques have been used throughout.

Environmental and sustainable design

Early design concepts are too often compromised by value engineering exercises.

We were dedicated to protecting the original design concept of the facility using digital innovation and DfMA to address design challenges, de-risk construction and introduce sustainable initiatives to enhance the proposals wherever possible.

We pushed for both the basement and roof structures to be DfMA. The basement was designed using eight prefabricated precast concrete elements. To reduce construction time, and dramatically increase safety onsite, these huge structures will be manufactured offsite, and floated or lifted into place.

“As a construction material, timber has a huge carbon sequestration impact. For the roof, we were instrumental in driving the adoption of timber as the primary material, visiting Europe’s largest timber suppliers to source wood from sustainable forests,” explains Graham.

On completion, Sydney Fish Market will feature the largest timber roof, by mass, in the southern hemisphere, capturing more than 1000 tonnes of carbon in the process.

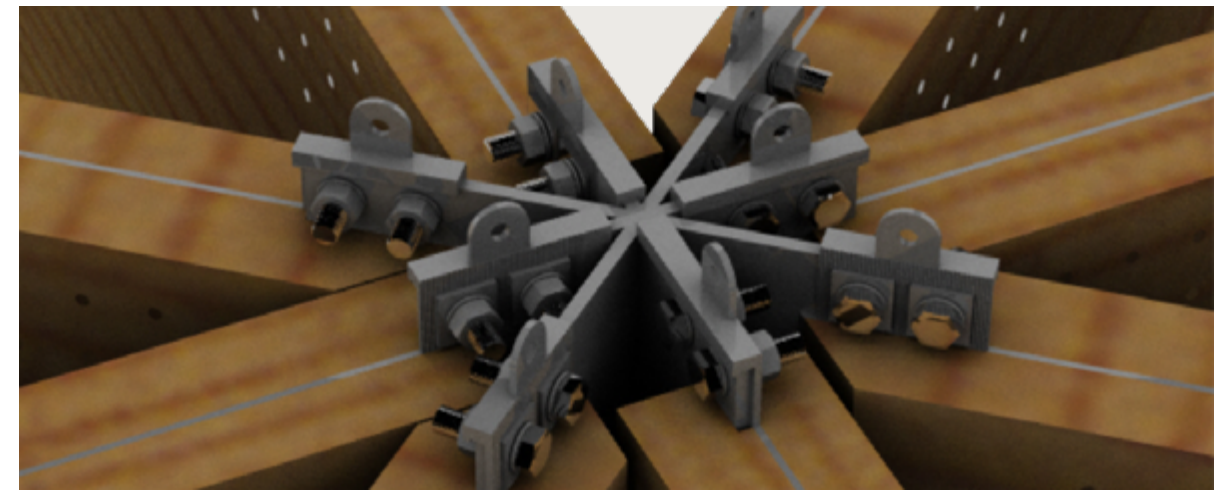
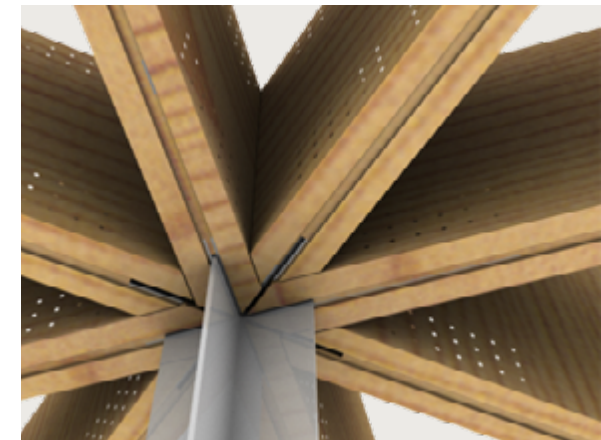
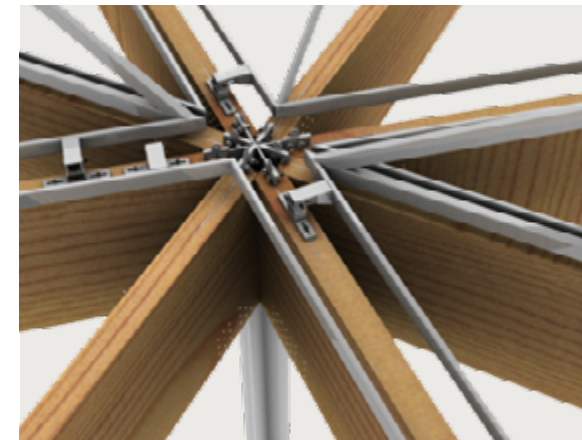
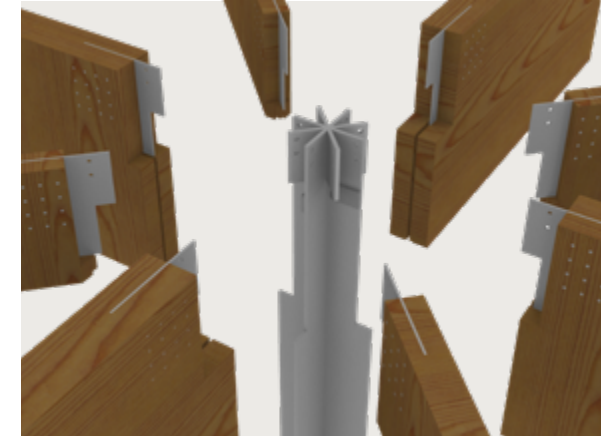
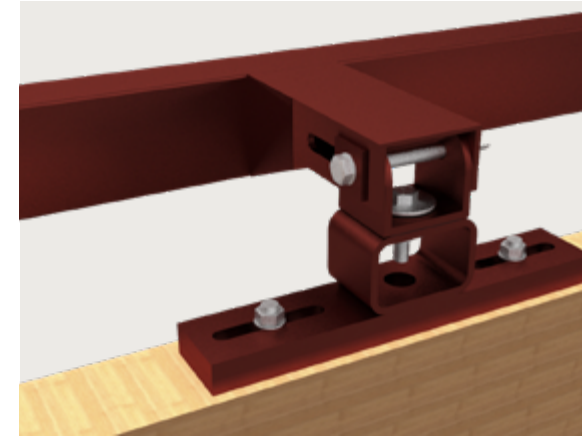
The roof itself is a timber gridshell structure comprised of more than 400 individual pod elements. Each module consists of eight beams that connect at star-shaped junctions. The gridshell has a slightly undulating, double-curved surface. Complex design details were resolved with help from our digital team, for example using parametric modelling to design every connection.

The beams are up to 1.8m deep and cantilever up to 12m from the building’s facade to provide weather protection and shading. Additionally, the roof design provides ventilation, allows daylight into the building interior, collects rainwater and supports 10,000m² of solar photovoltaic panels, meeting a sizable share of the market’s energy needs. We utilised innovative articulated joints and 3D-printed prototype connections, meaning the roof modules could be fabricated and assembled offsite for efficient and safe installation onsite.

Triangular openings allow natural light into the building, while their orientation provides shade against harsh sunlight, complimenting the design philosophy of making the market as permeable as possible to maximise natural ventilation and minimise the need for air conditioning.

“Mott MacDonald’s digital expertise was integral to our workflow,” comments Fred Holt from 3XN. “The ability of the digital team to rapidly assess, rationalise and document our changing geometry was vital to ensuring the operational feasibility and financial viability of this very important feature element.”

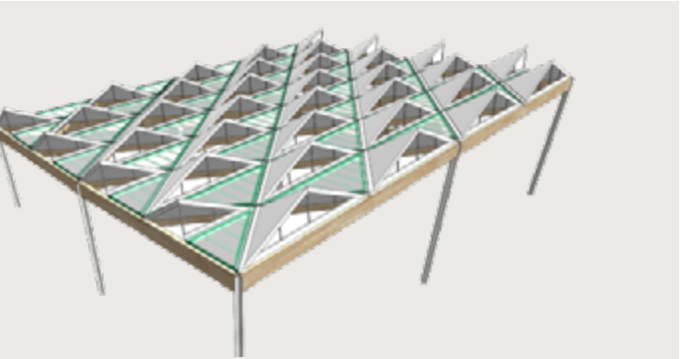
The roof modules were designed using innovative articulated joints and 3D-printed prototype connections.



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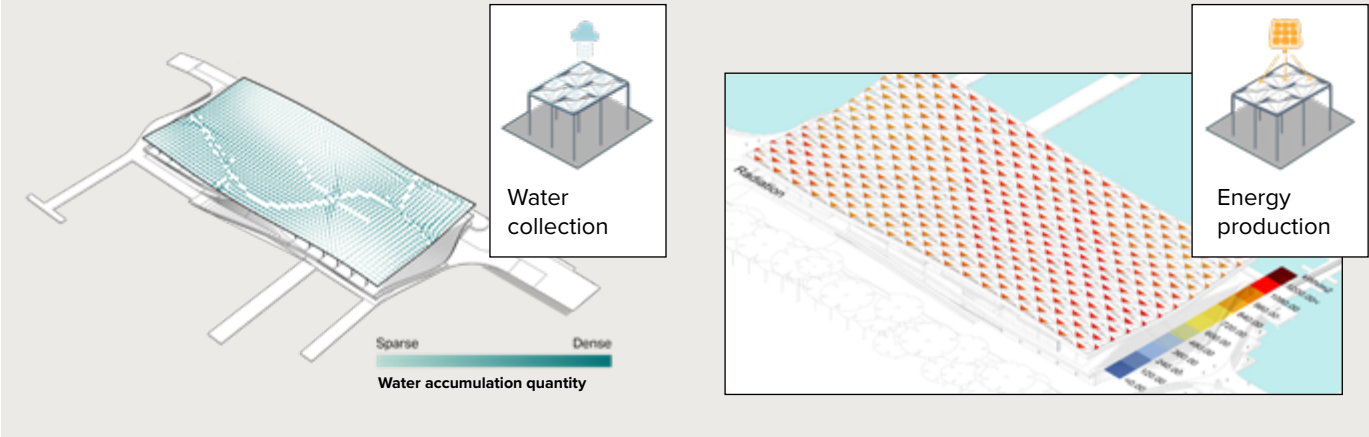
Utilising and enhancing nature

In March 2021, Sydney experienced some of its worst flooding in 60 years. With the new facility located over a significant body of water, and with rising sea levels, flood protection was always going to be a consideration, but the chosen site also happened to overlap with a local drainage basin.



Triangular openings in the roof allow natural light into the building, while their orientation provides shade against harsh sunlight.

The roof design houses an approximately 10,000m² array of solar panels, as well as an efficient water capture system.



Our team worked with local utility provider Sydney Water to ensure they were happy with how the market would interact with drainage zones, and that the new building would not interrupt upstream overland flow paths.

Effort was also put into regenerative design to enhance aquatic life around the new market's promenade area. We worked with the University of New South Wales (UNSW) to incorporate 3D printed coral elements to the underside of the structure and improve sea life habitat on the sea wall. We also wanted to encourage the capture and reuse of energy and water to reduce mains utilities use and regenerate plant life wherever possible.

The roof's unique design will channel rainwater through a rooftop 'river system' into large sumps, and then feed it into the promenade's 'water sensitive urban design' initiatives.

The new Sydney Fish Market is the catalyst for billions of Australian dollars' worth of urban regeneration. The development drives the redevelopment of the entire Blackwattle Bay precinct, while safeguarding the markets – a national cultural institution – for another 50-100 years. The new facility is expected to bring in millions of tourist dollars into Sydney and will serve as an example internationally of the benefits of both sustainable and regenerative design.

10,000m²
array of photovoltaic solar panels

Opening opportunities
with connected thinking.