



DISCIPLINE CASE STUDY

# Sustainability

OPPORTUNITIES  
THROUGH  
EXCELLENCE

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INTEGRATING SUSTAINABILITY FROM THE OUTSET

# EastLink WA

PERTH, WA, AUSTRALIA  
 CLIENT: MAIN ROADS WA

**BG&E led the first-ever program approach to the ISC Planning rating scheme for EastLink Western Australia (WA), achieving a Silver rating across all packages and the program. Under our leadership, sustainability and innovation opportunities were integrated and embedded throughout the planning and development of the project as a core objective.**

EastLink WA is WA's largest road network planning study that forms the start of the Perth Adelaide National Highway (PANH) to link Perth to the eastern states via Adelaide.

The project scope involved the development of 65 kilometres of urban and rural highway that traverses complex urban and peri-urban freeway-type operations along Reid Highway and Roe Highway, with eleven grade-separated interchanges connecting to lower-order arterial networks.

The study was undertaken under a collaborative contractual model via an Integrated Project Team (IPT). In 2021, the GHD and BG&E Joint Venture formed the EastLink WA IPT with Main Roads, to undertake planning, design development and project scoping works.

The scope of works included:

- Critical network operation and traffic engineering components.
- Alignment and project definition.
- Environmental approvals.
- Infrastructure Sustainability (IS) rating.
- Stakeholder engagement.
- Land identification for acquisition.
- 15% detailed design documentation.

Other key sustainability initiatives that were considered in this planning study included:

- Preliminary life cycle carbon calculation to identify priorities and opportunities.
- Co-design with local First Nations stakeholders of a framework enabling future cultural and economic opportunities for the project.
- Development and implementation of a robust decision making framework to consider sustainability objectives from an early stage.

REMEDIAL STRATEGIES TO EXTEND ASSET LIFE

# Banana Shire Council Water Reservoir

TAROOM, QLD, AUSTRALIA

CLIENT: BANANA SHIRE COUNCIL



**BG&E were engaged by Banana Shire Council (BSC) to conduct a sustainability assessment, considering different remedial options for the life extension of water reservoirs.**

The Taroom Clear Water Reservoir is a 0.45 ML concrete tank, located near the heart of the rural town. Built 52 years ago, the structure forms a critical part of the local community's drinking water supply.

The structure displayed signs of age, including cracking, spalling and surface loss on the internal concrete face. The BSC required a condition assessment of the structure to determine remedial actions.

BG&E undertook a detailed condition assessment of the external and internal face of the concrete reservoir. This found that the surface loss on the internal concrete face did not pose as great a durability concern as initially thought. However, our findings concluded that the concrete structure was nearing the end of its life, and remedial options were prepared.

The extension of the asset life avoided a range of impacts associated with demolishing and rebuilding a new asset, including carbon emissions.



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## DURABILITY ASSESSMENT & CONSTRUCTION SUPPORT

# 435 Bourke Street

MELBOURNE, VIC, AUSTRALIA

CLIENT: CBUS PROPERTY

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**Architecturally designed by the multi-award-winning Bates Smart, 435 Bourke Street will set a new benchmark for sustainable office development and design, being one of the first office towers in the world to feature a 'solar skin' façade.**

BG&E Façade Consultants were engaged from early concept to the completion of the project. We were closely involved with the design specification, due diligence, proof of concept, and pretender prototyping of the solar skin to facilitate procurement of what is one of the largest Building Integrated Photovoltaic (BIPV) installations in the world.

435 Bourke Street is one of the first all-electric A-grade commercial towers in Melbourne.

The project had some very challenging sustainability targets with 6 Star Green Star

and NABERS, as well as a Platinum WELL certified rating. Part of the certification had a 30 percent reduction of body embodied carbon emissions.

In line with Cbus Property's commitment to Net Zero Carbon, which has been fast-tracked to 2022, 435 Bourke Street is designed to achieve Net Zero Carbon in operation, with up to 20 percent of its fully electric base building electricity requirements generated on-site by its solar skin design. The balance of the building will be powered by offsite renewable electricity.

ADAPTIVE REUSE OF ASSETS

# Quay Quarter Tower

SYDNEY, NSW, AUSTRALIA

CLIENT: MULTIPLEX

**BG&E provided structural and construction engineering services (including permanent and temporary works) and materials testing services (including highly complex modelling and analysis) to Quay Quarter Tower (QQT) - a highly sustainable commercial vertical village that is recognised as the largest adaptive reuse project in the world.**



In a construction world-first, one side of the tower was demolished and reconstructed, while the other side of the tower was retained and refurbished simultaneously – enabling significant environmental and operational efficiencies. During the upcycle of the existing building, around two-thirds of the tower's original core was retained – conserving approximately 12,000 tonnes of embodied carbon when compared to the traditional demolish and rebuild route.

The upcycled QQT now boasts doubled usable area and user accommodations, compared to the original tower – from 45,000 square metres to 102,000 square metres of usable area, and from 2,500 to 9,000 user accommodations, respectively.

The global recognition bestowed upon QQT is a testament to an ambitious team, innovative design, and technical engineering excellence. It was awarded the 'World Building of the Year' at the 2022 World Architecture Festival (WAF) in Lisbon and received the prestigious 2022/23 International High-Rise Award. These accolades highlight the extraordinary transformation and sustainability of the project, setting a new global standard in adaptive reuse.



*Quay Quarter Tower –  
Sydney, NSW, Australia*

SUSTAINABILITY IN DESIGN

# Optus Stadium

PERTH, WA, AUSTRALIA

CLIENT: MULTIPLEX



**BG&E provided civil and structural engineering services for Optus Stadium, Australia's third largest stadium. Formerly New Perth Stadium, Optus Stadium was completed in 2018 and accommodates up to 60,000 patrons, with potential expansion of up to 70,000 seats.**

The civil design focused on addressing the existing land conditions of the 73 hectare precinct to reduce the ongoing maintenance of the pavements, roads, in-ground services, and key landscaped areas such as the community oval. This was undertaken over the asset's design life - while minimising the impact of the design and construction on the surrounding important ecological features such as the Swan River and River-fed Lake.

The civil design also recognised the interfaces with the surrounding State Transport

Infrastructure, to ensure an integrated design approach to the civil and landscaping works.

The civil works and stormwater design philosophy was to provide a sustainable and environmentally considerate design solution integrated within the landscaping vision for the sports precinct. With the Swan River Foreshore as a significant existing public realm resource - the project provided an important opportunity to ensure that this resource is maintained and enhanced from environmental, infrastructure, health and safety, and ecological perspectives.

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RESEARCHING CIRCULAR ECONOMY APPLICATIONS

# Power Generation By-Product Assessment

QLD, AUSTRALIA

CLIENT: STANWELL CORPORATION

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**The BG&E Materials team has a wealth of knowledge in the use of alternative materials derived from waste streams and has worked with clients such as the Ash Development Association of Australia, Delta Electricity, AGL Energy and Energy Australia.**

Fly ash has been extensively used as Supplementary Cementitious Material (SCM) in the production of construction materials and concrete applications in Australia since 1958. This, however, only reflects a proportion of the material produced, with the majority being stored in dedicated ponds or repositories at power stations.

In Australia, about 12 million tonnes of Coal Combustion Products (CCPs) are generated annually as a waste product of burning coal for electricity – the majority of which is fly ash. Only some 20% of this CCP is beneficially reused and over 600 million tonnes of CCPs are currently stored in repositories and ash dams across the country, representing a significant opportunity for the sustainable reuse of this byproduct.

The use of repository and dam-sourced fly ash could:

- Improve the quality of supplied concrete.
- Be used as an aggregate (rock and sand components) in concrete products, fill materials, and road construction.
- Reduce the proportion of material stored in landfills.
- Supplement current quarrying requirements essential for building and construction.

Stanwell Corporation engaged BG&E to work collaboratively to identify, assess, and undertake a market analysis of Stanwell's repository ashes. The assessment identified specific products and markets suited for the material and provided a detailed assessment of these opportunities.

Recommendations were made and agreed upon that align with Stanwell's corporate goals - supporting their transition from coal to alternative power generation, potentially unlocking tonnes of material annually, and significantly reducing carbon emissions.



SUSTAINABILITY IN DESIGN

# Smithfield Bypass

BRISBANE, QLD, AUSTRALIA

CLIENT: QUEENSLAND GOVERNMENT DEPARTMENT OF TRANSPORT & MAIN ROADS

**The \$164 million Smithfield Bypass is a vital piece of infrastructure for the northern beaches of Cairns, in Far North Queensland. The new bypass aimed to remove regional traffic from the local road network, resulting in benefits for the townsite, as well as safety and congestion improvements for all road users.**

In partnership with HDR, BG&E provided design management, bridge and staging design, and civil and traffic engineering services for the bypass which was opened in 2021.

One of the most accessible ways to achieve sustainability outcomes in the infrastructure sector is to critically evaluate all components to identify challenges and opportunities - looking beyond project boundaries and into the longer term. Delivering 'leaner' projects conserves energy during construction, reduces waste, and minimises material use - lowering embodied carbon from production, transportation and installation.

We were involved in Smithfield Bypass from the detailed design stage. When comparing the original project design and the long-term 'ultimate' design, our team identified an opportunity for an alternative road layout that avoided the need to construct one of the interchanges. Not constructing this redundant interchange eliminated the need for millions of dollars in additional infrastructure that

would be obsolete within 10 years, delivering significant whole-of-life savings.

The new structurally and sustainably efficient layout achieved an Excellent Design rating under the Infrastructure Sustainability Council's Infrastructure Sustainability rating scheme.

The change to the scope resulted in challenges to the design development process and keeping to the original required timeframe for construction. To manage this, the team adopted an open, transparent and collaborative approach with the Client. Design works were provided in a rapid and prioritised order, enabling some aspects of construction to proceed while the design was still underway, which reduced project timeframes.

Our successful identification and implementation of a better solution within the same timeframe underscores BG&E's commitment to achieving whole of project benefits through design.

SOCIAL & ECONOMIC LEGACY

# New Fitzroy River Bridge

KIMBERLEY, WA, AUSTRALIA

CLIENT: MAIN ROADS WA



**Flooding generated by ex-tropical Cyclone Ellie between December 2022 and January 2023 caused significant damage to the sections of Great Northern Highway at Fitzroy Crossing in the remote Kimberley region of Western Australia.**

The Fitzroy River Bridge was significantly damaged along with 500 metres of road - cutting access to Aboriginal communities east of the Fitzroy River as well as the East Kimberley and Northern Territory.

Given the critical importance of this bridge to the community and State and National Road network, Main Roads WA sought to have a new bridge structure and access roads completed within the shortest practical timeframe, with the elements that could be impacted by water flow completed before the next wet season. As a part of the Fitzroy Bridge Alliance with

Georgiou and BMD Group, BG&E adopted a streamlined and focused approach to restoring this critical link, with sustainability initiatives targeting four key areas:

- Lasting and sustainable social and economic outcomes.
- Working in partnership with the community.
- Resilience - contributing to a stronger Kimberley.
- Making best use of local resources.

We provided bridge design services for the Fitzroy River Bridge replacement project, which included:

- A new two-lane traffic bridge over the Fitzroy River.
- Integrating a pedestrian pathway.
- Reconstructing bridge approaches.
- Implementing flood and scour protection.
- Managing the protection and relocation of utility services.
- Flood modelling and hydrology.
- Temporary causeway and access road.

The new bridge is 100 metres longer than its predecessor at 270 metres long and twice as wide at 12.4 metres wide. The bridge is an eight-span continuous bridge with weathering steel-concrete composite deck. The bridge superstructure was incrementally launched from the western abutment and completed in 32 days.

Blade wall piers with pile caps were installed and the supporting piles of the bridge substructure were placed significantly deeper than the old piles to cater for scour in the riverbed during extreme flood events.

The remote location posed a challenge for transport of materials to site. To make the best use of local resources, the project tracked material inputs and outputs, and tested local aggregates for suitability for pavement, concrete and rock protection. This enabled appropriate choices for the project, and provided valuable data for future projects in the region. Significant reuse of materials was achieved onsite, and surplus material stockpiled for future projects.

The bridge design and construction methodology maximised local workforce participation, providing employment and business opportunities and transferable skills.

The New Fitzroy River Bridge opened to traffic, more than six months ahead of schedule. This project is set to have a lasting and sustainable legacy for the community surrounding Fitzroy Crossing - reconnecting East and West Kimberley and creating skills development and economic opportunities.



*New Fitzroy River Bridge - Kimberley, WA, Australia*

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At BG&E, we are united by a common purpose – we believe that truly great engineering takes curiosity, bravery and trust, and is the key to creating extraordinary built environments.

Our team of more than 1100 highly skilled people, in offices across Australia, New Zealand, Singapore, the United Kingdom and Middle East, design and deliver engineering solutions for Clients in the Property, Transport, Ports and Marine, Water, Defence, Energy and Resources sectors.

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