



Geotechnical







## The Beca Group

Founded 90 years ago, Beca is one of Asia-Pacific's leading engineering and related services consultancy groups. From prestigious landmark developments to functional and environmentally sustainable projects, Beca's multi-disciplinary range is broad.

---

### Introducing Beca Geotechnical

For 35 years, the Beca Geotechnical team has been helping clients from across the spectrum understand the ground conditions and related hazards of their project sites, always aiming to add value with the development of smart, economic geotechnical solutions.

All project locations are not created equal. Ground conditions vary from site to site, even within the footprint of a single development. The right advice and geotechnical input, factored early on into project budgets, can help avoid costly surprises. Geotechnical information, delivered at the correct time, can be a project-saver.

With diverse experience gained inside and outside Beca, our large team of specialist geotechnical engineers, engineering geologists and hydrogeologists work

together to identify and manage ground risks. At the same time, we work together to solve some of the most complex problems in the ground. And our portfolio is testament to that know-how.

Initial site investigation and evaluation is an essential part of sound project decision making. However, being involved throughout the life of a development gives Beca Geotechnical the opportunity to add considerable value to projects. Ways in which we help clients include developing cost-effective design concepts and assisting clients to manage ongoing ground-related risks.

Our valuable combination of local knowledge and global reach differentiates us from other specialist geotechnical consultancies. As part of the multi-national Beca Group, Beca Geotechnical regularly contributes staff to integrated design teams working on some of the biggest infrastructure projects around, in some of the most geotechnically challenging conditions.

Time and experience collaborating with other disciplines, clients and industry providers have equipped us with a precious asset: understanding what matters to our clients and project partners - from their point of view.

# Local Knowledge + Global Experience

Engineering Geology / Hydrogeology / Geotechnical Engineering

Beca Geotechnical is built on sound thinking and diverse experience. Our objective is to solve some of the most complex problems in the ground and bring these solutions to our clients in a timely and cost-effective manner. Collaborative working is our forté and can lead to outstanding results for our clients.

## ▶ Stage 1 // Strategic Advice

Helping the client to evaluate their options by identifying project opportunities and hazards; initial screening of a site beginning with preliminary appraisals or desktop studies

## ▶ Stage 2 // Technical Investigation

Undertaking geotechnical site investigations designed to suit both the site constraints and the proposed development; testing of samples in Geotest, our in-house laboratory; developing a geotechnical model for the site; investigating slope and structural failures

## ▶ Stage 3 // Geotechnical Analysis

Understanding data and providing recommendations to the client for their project; developing mitigation strategies for resource consenting; culminating in documentation for construction

## ▶ Stage 4 // Construction, Monitoring and Support

Carrying out technical inspections to confirm design assumptions; monitoring of construction effects within and beyond the site; understanding the drivers of the wider project team and working collaboratively to achieve tailored outcomes

---

= Emphasis on total project lifecycle

---

## Geotechnical Appraisal

Site inspection // Geological mapping // Aerial photograph interpretation // Defect mapping and stereonet analysis // Assessment of historic geotechnical data // Development of geological model

## Specialist Hazard Studies and Disaster Risk Management

Quantitative risk assessment // Slope instability // Fault activity // Seismic and tsunami hazard // Volcanic contingency planning



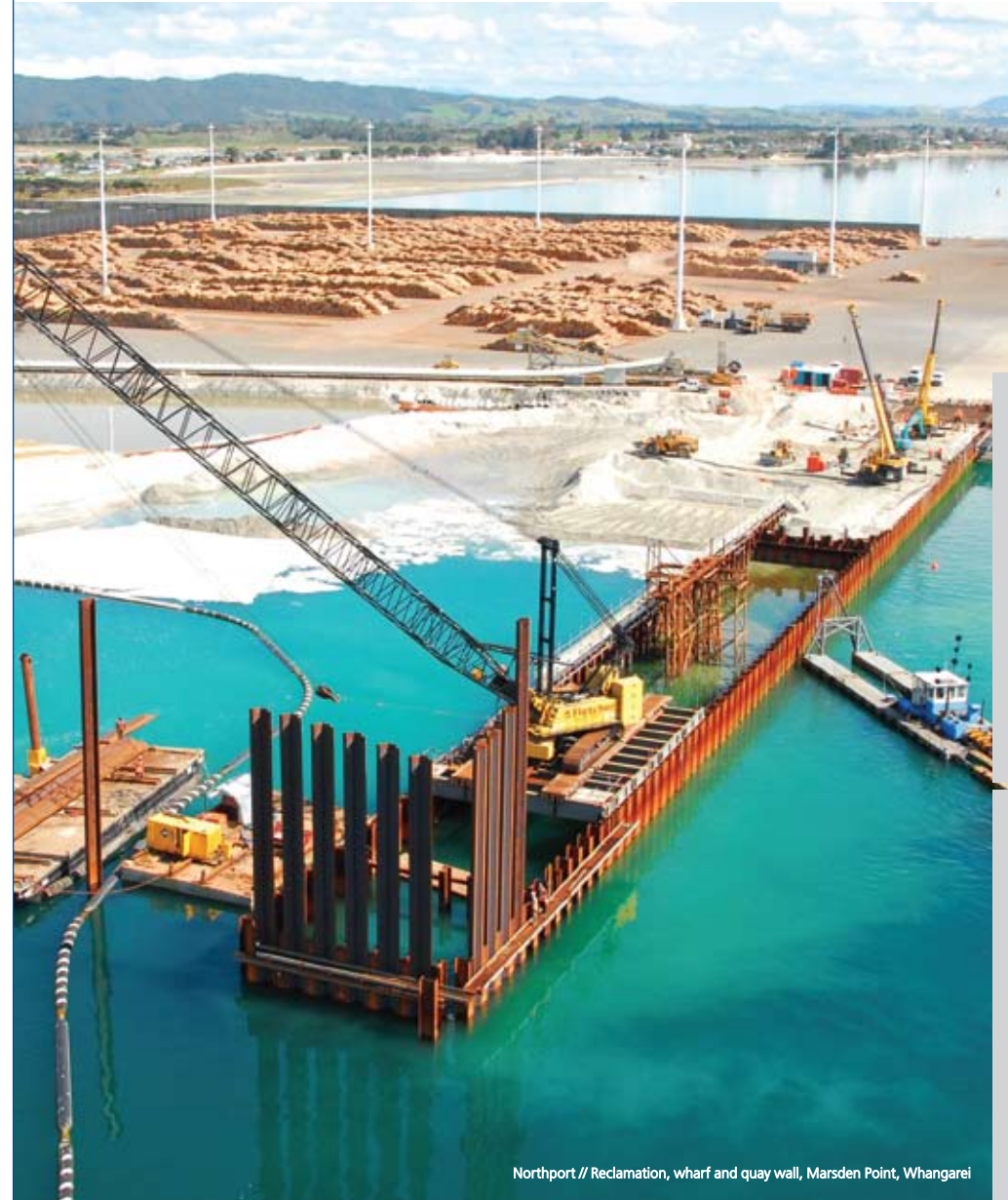
## Geotechnical Investigation

Machine boreholes // Cone penetrometer tests // Hand auger bores // Test pits //  
Deflection tests // Seismic surveys // Instrumentation and monitoring //  
Groundwater pump wells // Laboratory tests



## Geotechnical Analysis

2 and 3D modelling and evaluation of soil structure interactions // Foundations //  
Retaining structures // Slope stability // Pavement design // Dams // Ground improvement //  
Seismic and liquefaction assessment // Settlements // Reclamations





## Engineering Geology

Geological mapping and carefully scoped investigation are integral to developing a sound geological model: an essential precursor to evaluation of site development opportunities, geological hazard assessment, cut and fill slope and foundation design.

Beca's engineering geologists have wide experience in the use of remote and field based mapping and investigation techniques to provide the information needed for project planning through to detailed design and construction.

They have conceived innovative methodologies for the assessment of hazards and evaluation of risk, and continue to develop this expertise through international links.

## Geotechnical Engineering

Beca Geotechnical's engineers thrive on a mix of complex and varying projects, with involvement spanning concept design to detailed design and through to construction. With every proposed site and development, we strive to quickly develop an understanding of the behaviour of the underlying soils.

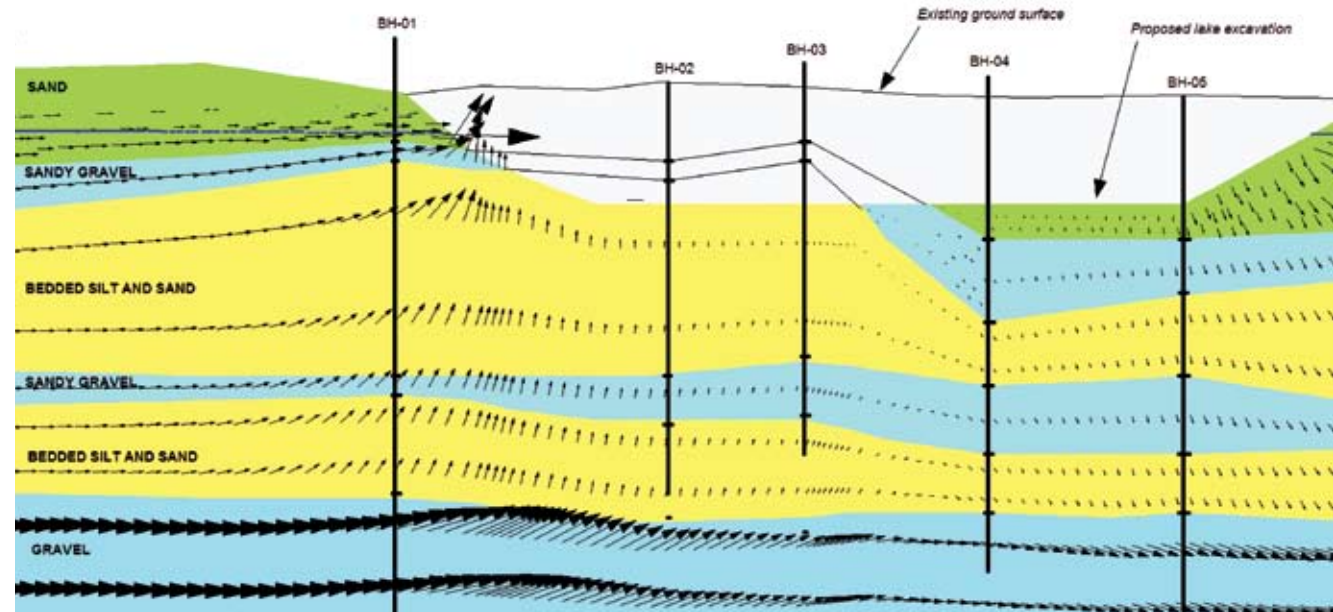
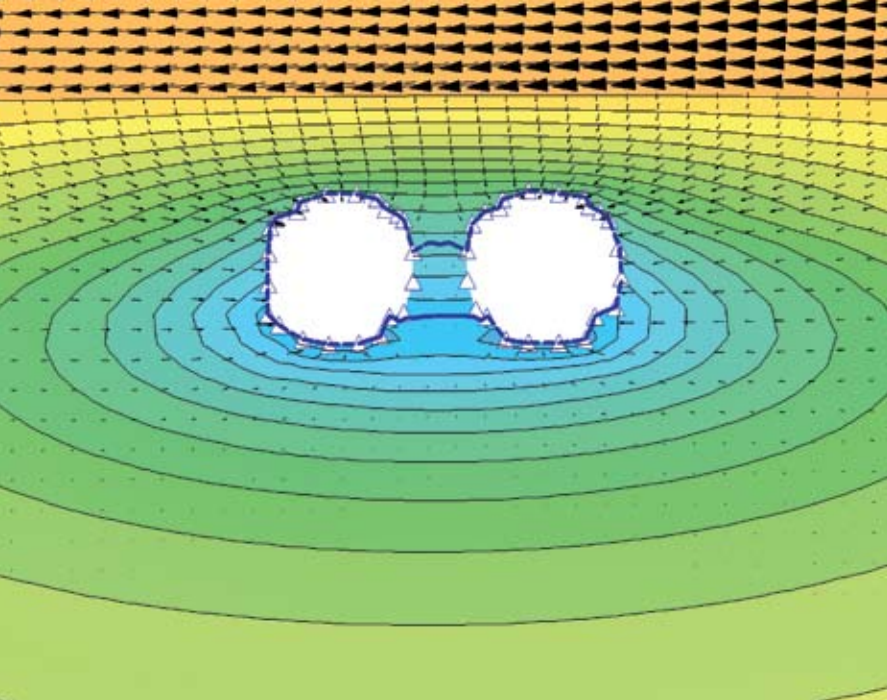
Complex projects require a broad range of geotechnical skills and innovative thinking. Beca Geotechnical's engineers aim to consistently develop technically sound designs that reflect a keen awareness of construction practicalities.

## Testing Laboratory

Beca Geotechnical is supported by Geotest, an IANZ accredited geotechnical laboratory staffed by skilled geology and engineering specialists offering a complete range of independent laboratory and field-testing services to a wide range of clients. The laboratory is fully equipped for soil, rock, aggregate and concrete testing, providing technical data and site support to assist designers and contractors.



Slag dump // PT Inco, Indonesia



## Hydrogeology

Beca Geotechnical's hydrogeology team is highly regarded, as evidenced by its rapidly expanding hydrogeology client portfolio. In addition to groundwater developments for water supply (deep ground water bores), our hydrogeologists are skilled at identifying, evaluating, mapping, modelling and monitoring the effects of construction on groundwater flow and developing mitigation strategies and design solutions for tunnels and excavations.

Beca's hydrogeologists develop and evaluate design concepts to help clients comply with strict environmental requirements. These include assessment of site suitability for land application of wastewater, through to the design of pond and landfill liners and assessment of environmental effects.

Beca Geotechnical operates with the philosophy of 'best person for the project', irrespective of geographic location. Our project teams comprise people whose skills and experience create the right mix for the project. Location isn't an issue – we have the resources and flexibility to go where our clients need us.

---

## Our market segments

Airports // Commercial Office // Defence // Education // Environment Management // Earthquake Engineering // Food & Beverage // Forest Industry // Health // Hotels & Resorts // Land Development // Manufacturing // Mining and Metals // Oil & Gas // Ports & Marine // Power Generation // Power Transmission // Rail // Retail // Road Transport // Risk Mitigation // Sport // Telecommunication // Tourism // Water & Wastes

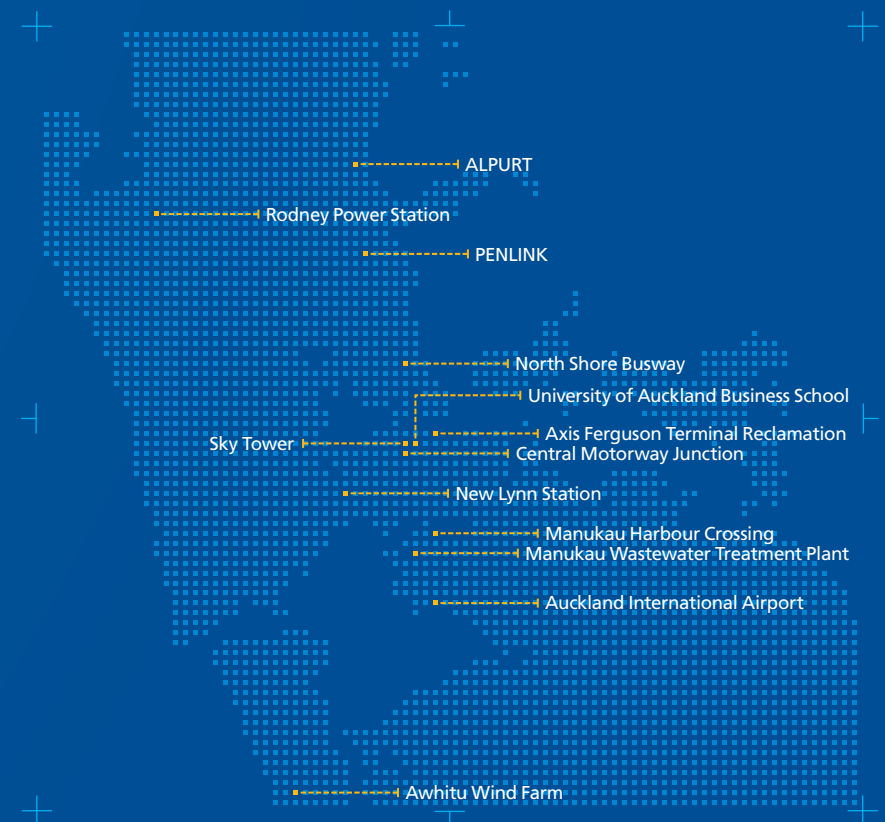
---



Beca Geotechnical's work across an extensive range of market sectors has resulted in a diverse client portfolio throughout New Zealand, Australia, Asia and the Pacific.

- Asia Pacific Nickel Project / Gag Island / Indonesia
- Lihir Gold Mine / Lihir Island / Papua New Guinea
- Aggregate Resources / Samoa
- Kings Wharf / Suva / Fiji
- Goro Nickel Mining / New Caledonia
- Northport / Whangarei
- Kawerau Geothermal Power Station / Kawerau
- Westpac Stadium / Wellington
- Otira Viaduct / Arthur's Pass

ENLARGED AREA // AUCKLAND REGION





---

## Wind Farms

**Client:** Various including: Genesis Energy, Meridian Energy, Mighty River Power, Contact Energy

**Location:** Various New Zealand locations including: Awhitu Wind Farm, Auckland; Project White Hills, Southland; Project West Wind, Wellington; Turitea Windfarm, Palmerston North; Waikato Windfarm, Waikato

**Services:** Site selection; investigation and analysis; development of concept design; foundation and access road design; construction stage input

New Zealand's thirst for renewable energy has resulted in a significant increase in wind farm development. Covering large areas of ground, often in hilly terrain, the construction of these farms requires massive equipment and the transportation of oversize loads. Turbine location selection requires a balance to be met between

the proximity of adjacent towers, sound foundation conditions and economic access road arrangements.

Working closely with energy clients and landowners throughout the country, Beca Geotechnical is applying the breadth of its experience to wind farm site selection and analysis, concept design development and detailed foundation and access road design. Ongoing geotechnical input during construction further allows us to tailor designs to site conditions and monitor foundation performance.

The physical extent of the farms means foundation conditions can vary between turbine locations. By characterising likely site conditions early on in a project, Beca Geotechnical can assist with the development and adoption of appropriate foundation systems, helping to avoid sub-optimal arrangements of towers and access roads becoming expensively locked in by the resource consenting process.

Our careful ground investigation, detailed analysis and confirmation during construction helps satisfy the strict limits on foundation performance set by wind turbine vendors. Beca's engineering geologists are also skilled at identifying and proving potential aggregate resources as close as possible to the site, producing vital material for both foundation concrete production and access road construction.

At Beca Geotechnical, we harness the power of our internal company relationships, working with Beca's geospatial and wind energy teams and other specialists from the earliest stages in concept development. We work closely with our transmission line engineers to select routes and develop a range of foundation systems for transmission lines connecting farms to the local or national grid.



---

## Macau Tower

**Client:** Sociedade de Turismo e Diversões de Macau

**Location:** Macau, Republic of China

**Services:** Geotechnical investigation, analysis and foundation design, construction monitoring and review

Beca Geotechnical joined forces with the multi-disciplinary, multi-national Beca team to design and oversee construction of the iconic 338m Macau Tower and Entertainment Centre, situated on a narrow strip of land separating the Pearl River from the newly created Nam Van Lakes in Macau.

This project was designed on a fast-track basis, with foundation construction, basement excavation and ground retention works beginning just four months after commencement of design works.

The 338m Tower rests on a 40m diameter raft foundation, with 26 piles (each 2.5m in diameter) reaching nearly 60m through the reclaimed land and river sediments and socketed into granite bedrock.

These piles were constructed using a reverse circulation technique, with special measures made to confirm the integrity of the piles upon completion and to check the foundation system could withstand extreme typhoon windloads.

An additional geotechnical challenge was the proximity of the Pearl River to the development's basement excavation with diaphragm walls being constructed immediately adjacent to the boundary sea wall.



**Australia**

Melbourne  
Brisbane  
Sydney  
Wollongong

**China**

Beijing  
Shanghai

**Indonesia**

Jakarta

**Myanmar**

Yangon

**New Zealand**

Auckland  
Christchurch  
Dunedin  
Hamilton  
New Plymouth  
Tauranga  
Wellington

**Singapore**

**United Arab  
Emirates**

Dubai

**United Kingdom**

London  
Stafford



This brochure is printed on 9lives satin paper from Cartiere Burgo. 55% recycled 45% from plantations managed under FSC certification bleached chlorine free. Printing using vegetable based inks.

© 2008 Beca. All rights reserved. "Beca" refers to one or more of the Beca group of companies, and/or joint ventures in which they participate. Please note that individual projects and or services referenced in this document have not necessarily been undertaken by the Beca entity with which you may contract. Due to the nature of this publication, we have referred to our business sections by discipline, rather than by the Beca company within which they sit. If you are unsure of the Beca company with which you are dealing, please contact us or visit [www.beca.com](http://www.beca.com) for further information on the Beca group. The information in this publication is provided without any express or implied representation or warranty in relation to any contract which may be entered into.

