A Firm Foundation
Stan Arneil

The Story of Gutteridge Haskins & Davey (GHD)
In this our 85th year of GHD, I am pleased to introduce a re-presented version of A Firm Foundation. The book was originally printed in 1988 on the 50th anniversary of our business. It provides an account of the company’s growth from humble beginnings in 1928, through periods of historical significance during the 20th Century and its initial forays outside of Australia.

At the time this book was written, GHD employed around 650-700 people and was still an Australian company, albeit one which had established a joint venture in Malaysia. The company has expanded substantially since, and today has more than 6500 people spanning five continents and 100+ offices globally. This subsequent growth is summarised in the chart overleaf.

In reviewing the original book, we have observed that the writing style, and content may not be in keeping with the evolved company we sit in today. That said, we have made the conscious decision to reprint the book unedited and hope that you enjoy it as it is intended: a view of our company through an historical lens, crafted as an anecdotal account of where we have come from. It can be acknowledged that this history forms part of who we are today.

I am regularly asked for a copy of this book by those keen to understand the heritage of GHD. From this book, you get a sense for the development of the values and culture which underpin GHD as we now know it. You also get a sense of the important platform created by those who came before us - a very ‘firm foundation’ on which to build a great business.

I trust you will enjoy the read and encourage you to share this delightful story with your colleagues, family and friends.

Sincerely

Russell Board
Chairman
### The GHD journey

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
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<tbody>
<tr>
<td>1988</td>
<td>GHD carries out planning services for World Expo 88 in Brisbane and opens an office in Coffs Harbour.</td>
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<td>1990</td>
<td>International projects burgeon and GHD opens offices in the Philippines, Thailand and Vietnam.</td>
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<td>1995</td>
<td>GHD acquires the Water Corporation of Western Australia’s water engineering group.</td>
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<td>1999</td>
<td>Manukau Consultants Ltd (NZ) join GHD.</td>
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<td>2000</td>
<td>Martin &amp; Co in Gladstone join GHD.</td>
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<td>2001</td>
<td>Smith and Wood Consultants, NZ join GHD. The company also acquires MME in Doha, Qatar and in Dubai and Abu Dhabi.</td>
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<td>2002</td>
<td>GHD merges with Geo-Eng Group and EGIS Consulting Australia. GHD now employs more than 2300 people.</td>
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<td>2003</td>
<td>GHD celebrates its 75th year of operations.</td>
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<td>2004</td>
<td>Baker Saran, NSW, joins GHD.</td>
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<td>2005</td>
<td>GHD merges with AJP, Malaysia, Qest Consulting, NSW, City Design, SA, and Civil Design Services, NZ.</td>
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<td>2006</td>
<td>GHD broadens its reach in Hong Kong, China and the UK, completing mergers with Rankine &amp; Hill, a Hong Kong consulting engineering company, and Archispace, a provider of urban planning, architectural and landscape design services throughout China. An alliance is formed with London-based AMCL, and GHD offices open in York and London.</td>
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<td>2007</td>
<td>Three companies joined GHD including Leddy Sergiacomi &amp; Associates, a Queensland engineering and environmental consultancy company, ProAnd, a New Zealand specialist meat process design engineering consultancy and PCT Engineers, a Western Australia/Queensland consultancy company.</td>
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<tr>
<td>2008</td>
<td>GHD celebrates 80 years. Hassall &amp; Associates, a consulting firm specialising in international development assistance, agriculture, natural resource and environmental issues joins GHD. Offices are opened in Ireland and Canada.</td>
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<tr>
<td>2009</td>
<td>GHD employs more than 6000 people. Four strategic mergers are completed in the USA including RoseWater Engineering, the Arizona Engineering Company, CSA Engineering and Stearns &amp; Wheler.</td>
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<td>2010</td>
<td>GHD continues to grow its operations including strategic mergers with SMGC in the mining sector in Australia and China Water International Engineering Consulting Company (CWIECC) in China. The health and safety of our workforce was recognised with the 2010 Best Workplace Health and Safety Management System Award.</td>
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<tr>
<td>2011</td>
<td>GHD merges with MGF Consultants in North Queensland, Australia, CollinsonDutton Ltd (CDL) in the UK as well as Winzler &amp; Kelly, Commonwealth Engineering &amp; Technology, Inc (CET) and RobsonWoese in the USA.</td>
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<tr>
<td>2012</td>
<td>GHD acquires The Sernas Group in Canada’s Greater Toronto Region and the Water Sciences Group of Australian Laboratory Services in Australia. The company is also named the fourth most attractive company to work for in Australia by recruitment firm Randstad and recognised as the best waste consultant in Australia according to a survey completed by Inside Waste Magazine. Employee numbers reach 6500.</td>
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A FIRM FOUNDATION

STAN ARNEIL

The Story of Gutteridge Haskins & Davey Consulting Engineers 1928-1988

GHD

Australia 1788-1988
An Endorsed Bicentennial Activity
By The Same Author

Forming and Running a Credit Union
Secrets of the Board Room
One Man's War
Black Jack
One Man's Family

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CONTENTS

Acknowledgments vii
Foreword by Sir John Holland BCE, Hon D Eng, FIS, FIE Aust, FAIM ix
Introduction xi
Chapter 1 The Founders 1
Chapter 2 Coming Together — Pre World War II 19
Chapter 3 World War II 25
Chapter 4 Van Dieman’s Land 31
Chapter 5 This is the Place for a Village 41
Chapter 6 In Sydney Town 59
Chapter 7 Southern Queensland 71
Chapter 8 North Queensland 87
Chapter 9 The ‘Top End’ 109
Chapter 10 King O’Malley Country 131
Chapter 11 Go West Young Man 139
Chapter 12 The Odd Job 145
Chapter 13 Ingenuity and Innovation 153
Chapter 14 Dams 161
Chapter 15 Water — Towards 2000 175
Chapter 16 Conquering the Distance 181
Chapter 17 Leisure 195
Chapter 18 The Environment 203
Chapter 19 Growing Stronger — The Associated Companies 211
Chapter 20 Helping our Neighbours 233
Chapter 21 Organisation, Management And The Future 247
Appendix 1 Notable Events 255
Appendix 2 Awards For Merit 261
Appendix 3 Some Significant Contributions To Professional Societies 265
Appendix 4 Corporate Philosophy 267
Index 269
All Principals of Gutteridge Haskins & Davey Pty Ltd are Corporate Members of The Institution of Engineers, Australia and most are Members of The Association of Consulting Engineers Australia.
ACKNOWLEDGMENTS

An historian is not a creative writer. He doesn’t ‘dream up’ a story nor does he — or rather, should he — distort facts. History can be written from two angles depending on which side one stands. The story of Clive in India, in which I gloried at school, reads quite differently from that now taught in schools on the Indian sub-continent.

The story of GHD covers more than half a century and includes the efforts of some notable people. To assemble the most accurate account, I have drawn on many sources.

The material published in “GHD News” has been very useful. This excellent little quarterly, previously prepared under the direction of Bill McCredie and now edited by Pamela de Lacy and Peter Hamilton in the Corporate Business Development Group, provides staff, clients and interested people with an overall picture of current projects and people of GHD.

I am indebted to the staff of GHD and to ex-staff for their extreme patience with me in those interminable interviews, and for their checking of my drafts and redrafts. I think we have the story right, to a marked degree as a result of their co-operation.

I am hesitant to mention particular names but there were some whom I relied upon time and time again. I feel I should say ‘thanks’ to Don Dwyer for his patience and understanding of the size of the work. I had little conception of the wide scope of GHD when I began the task; his encouragement has been a great help.

John Murray of Melbourne office checked and rechecked drafts, proffered suggestions and arranged all Victorian and Tasmanian interviews. Alan Strom of the same office gave me more time, perhaps, than he could spare and was of invaluable assistance with some important chapters.

Len Wilke of the Melbourne office has been of great assistance in my research into the details of GHD’s 1982 fire.

John F. Keays, who was a staff member, partner and director for forty-one years, checked all references to the early years and provided references which had not been available to me.

John McCann, a gentle man, as I saw him, was particularly painstaking in his examination of drafts I submitted to him.

Joan Dickinson, librarian in the Sydney office, advised me on material which would be useful and tracked down answers to many of my questions, and Bill McCredie pointed me in the right direction whenever I asked him for advice.

Norm Traves of Queensland was tireless in his efforts to assist me; his meticulous checking and rechecking of every word of the manuscript ensured complete accuracy and his suggestions undoubtedly provided me with an opportunity to present a more comprehensive view of the work of this group of people.

I owe a lot to Judy Sangster who typed and retyped my original drafts. Dawn Hardy, who took over the typing and presentation of the manuscript after Judy resigned, has been a tower of strength to me.
Permission to use the Gladstone anecdote about Geoff Davey has been given by the Local Government Engineers Association of Queensland and John Whitaker, who gave me the story.

Extracts from poems by Mary Gilmore, Leon Gellert, Vivian Smith, Chris Wallace-Crabbe, Roland Robinson, Les A. Murray, J.R. Rowland, Bruce Beaver, Kenneth Mackenzie, Judith Wright, and A.B. Paterson are copyright and have been used with the permission of Angus & Robertson, Publishers.

Permission has been granted by Oxford University Press, England, for use of the poem “In Sydney Town” by Peter Porter, and by Curtis Brown (Aust) Pty Ltd for use of the poem “Revelation” by Nancy Keesing.

I must pay a tribute to my friend Joan Clarke, editor supreme, for her meticulous examination of my drafts and her subsequent recommendations. Her craftsmanship makes it all look so easy.

A fire which gutted the Melbourne office in 1982 destroyed the complete records of the practice to that time for Tasmania and Victoria. No doubt there were many names included in those records which should have been recorded here. If I have been unable to unearth the work of many, who should have been mentioned but are not, I am sorry; the absence of their names was not intentional and does not detract from the importance of their contributions.

Perhaps at this time it would be fitting for me to repeat a few lines written some years ago by Rev. Father D. Brimstone, an Augustinian priest, at the conclusion of an historical article entitled ‘Unreliable Reminiscences’. He wrote:

‘As I read what I have written, I am somewhat dismayed because of:

The pain not published,
the names not named,
the tears not told,
the laughter not listed,
the sorrow not said,
the help not hinted at,
the secrets not sounded,
the accomplishments not acclaimed,
the energy not eulogised,
the comradeship not commended,
the sacrifices not sung,
the absent friends not applauded,
so much not mentioned.’

Forgive me.

Stan Arneil
October. 1987.
FOREWORD

by Sir John Holland, BCE, HonDEng, FIS, FIEAust, FAIM

What a window has been opened by this story of Gutteridge Haskins & Davey! It has revealed a breadth of engineering scope throughout Australia and near countries which has not been generally recognised. It reveals a grand record of professional competence and integrity. It is indeed a great privilege for me to have been invited to write this Foreword, not only because of my association with the firm but also because of my personal friendship with so many of the senior members.

For any professional practice or commercial entity to survive and flourish, there must have been sound initial policies, appropriate business philosophies and sound continuing leadership. To survive during the depression years was even more challenging and it was during those years that this great firm had its origins.

While it has been my privilege to have known most of the principals, I did not know Gordon Gutteridge well, but like to think that, had I not joined B.P. after graduating from Melbourne University in 1936, he might have offered me a position in his firm. He struck me then as a tall somewhat gaunt figure with a serious disposition, who had about him an air of competence. The author confirms that assessment and develops other positive aspects of his personality, which have been reflected in the diversity and growth of the practice.

I cannot recall meeting Haskins but I found Geoff Davey to be a most delightful and intriguing character. It seems somewhat incongruous that one with so much charm and wit and broad interests could be so positive and decisive with his handling of difficult construction situations in the field. He was a great innovator and had a precious and rare enquiring mind. He was a most congenial dinner companion and, not having been aware of his boyhood ambitions, it seemed quite a paradox to learn of his decision, in his sixties, to join the priesthood.

I first met Sir Bernard Callinan at Melbourne University in 1933, but since he was in his final year when I was a mere fresher, I did not see much of him in those days. But even then I felt that here was an engineer who would achieve distinction. He has, of course, done better than that and I believe has earned the right to be known as a ‘really great Australian’. He first achieved prominence when he commanded Sparrow Force in Timor, during World War II.

He was succeeded as Chairman of the firm by Mr Bob Rivett and Mr Ben Fink as Managing Director. They are both most competent engineers who have earned most enviable reputations in the profession, in the firm, in The Association of Consulting Engineers Australia and The Institution of Engineers, Australia. It was obvious that, with such leadership, the practice would continue to flourish.

The author points out in the final chapters that it now has an exceptionally broad coverage of the profession, including dams, railways,
bridges, power generation and distribution, mine development, materials handling, leisure industries and planning of the environment. All this has grown out of the municipal water supply and sewerage systems on which the practice was established.

While it is still a leader in these fields, the total fee income from these sources now is only a fraction of the total. The commendable policy for the growth of the practice has not only encouraged development of skills within, but has resulted in the development of solid associations with firms with specialist expertise both in Australia and overseas. It is growth which has brought strength, depth, competence and diversity.

Another aspect of the GHD service, which is referred to frequently throughout the book, is technological innovation for the solution of specific problems. Many of these problems within Australia have resulted from harsh climatic conditions and remoteness from established sources of the usual construction materials.

One of the fundamental weaknesses in the training of young engineers in Australia is an inadequate knowledge of the history of the profession and the achievements of many of its practitioners. A reading of this impressive volume would assist to some extent in redressing this problem. Those responsible for the distribution of the history should ensure that it will be available in all tertiary libraries throughout Australia, appropriate government departments and major organisations concerned with engineering and construction.

In summary, this is a proud story of a truly professional multi-disciplined international engineering consulting practice, the achievements of which must rank Australian engineers as competent as their counterparts anywhere else in the world.
INTRODUCTION

Observe this man, he is an engineer;
Notice his useful hands; his eyes are keen.
He has spent his life in the designing
And service — and faithful love — of the machine.
...........

His sight, being trained only to see essentials,
Can strip, the trees from the hills and the moss from the
boulders
Revealing the ultimate anatomy,
Spreading away from the plateau’s stony shoulders.

A mind that had thought too long in terms of blueprint
Discovered affinity with the slopes and the plain,
Losing itself in technical admiration
Of this enormous provision for stress and strain...

‘Revelation’
Nancy Keesing (1923 - )

When I first mentioned to some colleagues that I was looking forward to tracing the development of GHD, one of them said, ‘I’ve heard of that firm, they are consulting engineers and are the “water people”’. I was not too sure of the message my friend was trying to convey and to my further questions he replied, ‘They are not wholly water, but are almost so!’

I am afraid my friend was talking of a situation of fifty years ago; they were, at that time, almost wholly water but that situation has long since passed.

Gutteridge reasoned that the bread and butter basis of engineering work pre World War II was the expansion of water and sewerage work in all its facets. He was right, and his concentration on these disciplines earned him and the subsequent practice of GHD an Australia-wide reputation in ‘water’.

GHD is wholly water? Not on your life! In these days diversification is the ‘in thing’; it is a protection for shareholders if an industry begins to fade, like the iron tyre, gas lamps and the horse-drawn lorry. It is not unusual now to find that a shipping company owns an undertaking business, a chain of florist shops and manufactures ladies’ underclothes on the side, whilst even the staid undertaking firm may have a sideline in babies’ clothes and maternity wear.

GHD began diversification long before most people could spell it and they began it not to ensure a continuity of profit but to protect the interests of their dedicated staff. Gordon Gutteridge, one of the founders of the firm, was such a compassionate man that he hated the thought of being forced to sack any of his staff. Geoff Davey, another of the partners, had the same idea. Gutteridge began the policy of diversifying in all engineering disciplines in the four areas from which commissions can be won — Federal, State and local
government and private enterprise.

I have found that engineers are an inquisitive lot. They are obviously descended from witch doctors and sorcerers whose authority rested on their ability to harness the elements as a source of their own power. Modern day engineers are not witch doctors but they do seem to revel in the seeking of solutions to impossible problems and, what’s more, they find them. That’s sorcery in my book.

I am not a consulting engineer myself, definitely not even ‘handy’. I use an old-fashioned watch because I cannot even alter the time on the digital models! In a recent visit overseas I was almost reduced to a nervous wreck by my inability to control my digital watch. When I found myself having lunch at 3.00 a.m. I threw the watch away and felt better from that day.

Although not an engineer I can, with some modesty, say that I have worked on a variety of engineering projects where innovation was the norm. I have worked on an airfield, from the ground up, on a railway, helping to push it through jungles and hills and over rivers and culverts, on roads and on tunnels. It was the people who worked on those projects who were so interesting to me, rather than the projects themselves. Anyway, that’s the way I looked at it.

I would like to tell you about the engineers of GHD who have worked throughout our land for sixty years and in South-East Asia and the Pacific Region.

Their dedication and ability to innovate when required has been quite fascinating to me, as have some of the things they have done. To build a dam and store the water under the ground was odd enough, but to build a bridge where the surface was below the flood level staggered my imagination.

What has come through to me in researching for this book is the high ethical standard of the consulting engineering profession and the part which GHD has played, from Davey’s time, in fostering that profession. Ethics and professional integrity rate a long way ahead of price for consulting engineers. In the long and involved case (1975 to 1981) of the consulting engineers and the Australian Trade Practices Commission the engineers spoke against competition primarily on a basis of fees. Competition, they argued, should be primarily based on professional merit, in the belief that fee cutting could result in cost cutting, which could lower the quality of the project. This philosophy was outlined by John Ruskin (1819 - 1900) whose words still have a lot of horse-sense: ‘If you deal with the lowest bidder it’s well to add something for the risk you run and, if you do that, you will have enough to pay for something better.’

GHD is not an ordinary firm. The late Sir Howard Beale said of GHD ‘It is difficult to describe the firm’s remarkable influence on the nation. However, GHD’s record of achievement is a visible monument of enduring works such as dams, water and sewerage systems, railways, roads and bridges, industrial, commercial and institutional undertakings.’ I believe, with Sir Howard, that this is a remarkable firm, perhaps because of the philosophy of its founders who set the direction of its path.

In my travels throughout Australia, looking at dams and railways, beef roads and what have you, I often found myself wondering, ‘What would have
been the position had GHD not been actively engaged in the development of Australia for more than half of this century? The trite answer would always be that others would have done these things, anyway.

Well, it would be just as easy to say that, had Burke and Wills, McDowell Stuart, Ludwig Leichhardt or Bass not made their epic journeys, then others would have made them. The facts are, of course, that others did not do these things and, as Sir Howard Beale opined, 'full credit must go to those who did'.

Statistics are pesky things, usually quite boring, but some of the data I mulled over quite staggered me. GHD has been involved in the construction of 6500 plus kilometres of electric power lines — that's more than the distance from the Pacific to the Indian Ocean! — of 5900 kilometres of water pipelines and 4000 kilometres of sewer lines, the latter requiring five hundred pumping stations. Browsing, I learned of their involvement in sixty-five large dams and one hundred swimming pools. I wondered what would be the volume of water when measured on the established and well-tried Australian scale of measurement — how many times the volume of water in Sydney Harbour?

To 1986 GHD engineers had been involved in the construction of three hundred bridges, thirty airports and three hundred sewerage projects. As an afterthought, I noted a modest 1000 kilometres of natural gas pipelines and more than 6000 kilometres of roads, highways, railways and tramways — that also is more than enough to cross Australia! I stopped at that because, as I've already said, statistics can be boring and GHD's statistics just seem to keep multiplying.

One of the problems in writing of the engineering profession as a whole, and of consulting engineering in particular, has been the rapid pace of the development of the tools they use in construction and the equipment they handle in design. Where once the pick and shovel were essential to the job, the megabyte has taken over. Where slide rules were an important piece of equipment of their engineer — they carried them in their pockets with spare rules in their bags — the silicon chip now solves the problems.

It is possible that many of the young graduates coming from the engineering faculties of Australian universities today have never used a slide rule or they may be unaware that picks and shovels have moved mountains for a few thousand years and, in some parts of our world, are still doing so and doing it successfully. For them and for the engineers of tomorrow, here is the story of some of those remarkable people who have participated, and continue to participate in the development of our beautiful country.
The Founders

Who will weep me when I am gone?

Who tell my story? Who sing my song?

‘Of Old Men’
Dame Mary Gilmore
(1865-1962)

Consulting engineers are particularly careful to design foundations that will foreseeably sustain the structure they support under any circumstances.

Foundations are designed with a view to local conditions and, in earthquake-ridden countries, are built to absorb even such cataclysmic destruction.

The foundations of a business enterprise are built not of steel, concrete or rockfill, but of people, and provided the principles those people adhere to are correct, the business should not falter.

GHD was founded by three people, not suddenly, but as a gradual coming together of three kindred spirits who had much in common — honesty, dedication, loyalty, skill and a lot more — yet also many differences of style and approach. The shakedown into one mould allowed for all the shades of difference to play their part in building a national organisation with a reputation for integrity and engineering excellence second to none.

Here are the stories of those three founders of GHD who each believed in Australia and wished to play a part in its development.

Alan Gordon Gutteridge

Alan Gordon Gutteridge was born on 4 February 1892, in a period of great restlessness in Australian history.

The economic depression of those years saw the birth of the Australian Labor Party, pledged to change the then social system of the ‘haves’ and ‘have-nots’ by entering the parliamentary system. The aims of those desperate men to change the strata of society were not realised but the years were humming with change, leading up to the birth of Federation.

Gutteridge was of the ‘privileged’ class. His father was a medical doctor practising in Launceston at the time and the future of young Gordon was as assured as it could possibly be. The family included five children, four sons and a daughter, each of whom received an excellent education and rose to the top of his or her respective field.

Two sons, Eric and Noel, studied medicine and the daughter Mary chose child development, specialising in branches of their own choice, whilst Hal became an engineer. Hal moved to London and established a successful practice as a consultant in the mechanical engineering field. He became a prominent citizen of the City of London and served a term as Mayor of the City of Westminster.
Gordon attended Melbourne Grammar School from 1903 to 1909 and followed with study at Melbourne University, where his studies were interrupted by his service as a soldier in World War I.

Even as a lad Gutteridge did not enjoy good health and this necessitated, later, another break in his studies. He had serious doubts that he would be able to follow his chosen profession. He decided on an extended visit to the United States of America, where he was on 4 August, 1914, the day war was declared by Britain on Germany.

It speaks volumes on the bond between the brothers to learn that, without any communication, the three brothers enlisted in the colours within hours of each other in three different countries. Gordon travelled direct to Calgary the day war was declared and enlisted in the Canadian Army on 5 August. Eric enlisted in Australia on 4 August and Hal in London on 5 August.

Gordon’s war service included a period of garrison duty in beautiful Bermuda until July 1915 but by 18 November 1915 he was in France holding the rank of corporal. He took part in the battle of Ypres and the awful fighting on the Somme and won a field promotion to sergeant. In October 1916 he was badly wounded and was taken prisoner of war.

On recovery from his wounds Gordon made two unsuccessful attempts to escape. At the end of the war he was returned to Canada and after demobilisation there, he returned to Australia where he resumed his engineering studies in Melbourne.

In 1921 Gordon graduated from Melbourne University as a civil engineer. He began work immediately with the Harbour Trust but won a Rockefeller Scholarship for post-graduate study in sanitary engineering at Harvard University, USA. He was successful in obtaining his Master’s degree and, on returning to Australia in 1923, took up a position as assistant to an American, Colonel Longley, who was Director of the Commonwealth Division of Public Health Engineering.

Shortly after Gordon’s appointment, Colonel Longley returned to America and Gordon took over his position; he remained there for five years. Gordon’s work was of an advisory nature and entailed considerable travelling and dealing with public authorities and the people who ran them.

Gutteridge was a big man, 6 feet 3 inches (190 cm) in height, with a commanding figure. He developed a charisma which was quite remarkable, inasmuch as he was able to keep the goodwill of his listeners even though, at times, he severely upbraided them.

In 1924 he reported on the water supply for Deloraine, in Tasmania, in these words: ‘It is inconceivable that any progressive council would continue to supply such a water to any community under their jurisdiction, and to submit to the members of that community the manifold hazards consequent on such a supply. It indicates a culpable negligence on the part of the Deloraine Council for the welfare of their constituents and of the many tourists that are now attracted to their district.’

The most charitable reader would agree that such a tirade would normally raise a few hackles on the part of the listeners but what Gutteridge was saying
was in his experience the truth, and in his opinion had to be said.

The councillors accepted the recommendations and, in the fullness of time, the long-suffering residents of Deloraine were able to enjoy a glass of sparkling drinking water from their own taps.

Gordon Gutteridge made a foray into Queensland in 1927 when, while Commonwealth Director of Public Health Engineering, he was constituted a commissioner by an instrument wherein the Governor of Queensland referred to ‘his zeal, knowledge, learning, industry, discretion and ability’ and required him to enquire into ‘the most efficient and economical methods of providing and conserving an ample and pure water supply for the present and future requirements of the City of Brisbane’. They haven’t used such words in a public instrument in Australia for many decades. Perhaps the use of old-world courtesy would not go amiss in our present frantic existence.

As his work experience grew Gutteridge developed sound judgement in his assessment of engineering projects. John Keays, one of his first staff, was of the opinion, however, that the engineering profession did not recognise his engineering ability as it was overshadowed by his amazing charisma. Whilst still employed by the Commonwealth Government he was appointed Chairman of a Victorian Royal Commission on sanitation. The findings of the Commission made a major contribution to the knowledge and practice in this field and, in effect, laid down a blueprint for future development of the State’s sanitation needs.

The status of Gutteridge was also recognised by his appointment as Chairman of the first Commonwealth Conference on Public Health Engineering.

In 1928 Gutteridge was transferred to Canberra and decided that this city was one place which could do without him. He resigned from his secure, prestigious job, returned to Melbourne and set himself up in private practice as a consulting engineer specialising in water and sewerage schemes. Research has indicated that the date was 24 September 1928.

Gutteridge was a salesman of the top echelon and a shrewd businessman. It has been suggested that his concentration on water and sewerage stemmed from his belief that no matter how bad the depression became, water and sewerage was one area to which unemployed would be put to work as ‘relief’. He was right. The concept of concentrating government moneys on water and sewerage projects was initiated in New South Wales and was known as the ‘Spooner Plan’ after the then Minister for Local Government.

A major commission in the development of the Glenelg sewage treatment works in South Australia kept him afloat while he used his charisma to collect any job which could keep his business in operation.

Gutteridge made such a success of the Glenelg scheme that he won commissions for complete sewerage schemes for Warrnambool, Victoria, and Devonport, Tasmania, and on that base developed the practice into one of the largest in Australia in the field of sewerage and water supply.

As the depression deepened more and more money became available from State governments for the expansion of water and sewerage schemes; it
seemed to be always available as a means of providing at least some relief to the unemployed. The relief funds were called ‘the dole’ and were paid only to those people who were prepared to work for it, unlike today when ‘relief’ or ‘dole’ does not require the recipient to work.

Gutteridge worked hard and designed a complicated contact aeration plant for the treatment of sewage but decided that, due to lack of trained and experienced operating staff, future plants, and there were many of them, would use trickling filters.

Even the young engineers at the time found it difficult to keep pace with the dynamic Gutteridge.

Gutteridge was a master of presentation. In addressing councillors who usually included local tradesmen, farmers and businessmen, he made them feel that they were directors of their council, responsible for almost everything in it. His submissions were meticulously typed, a copy for each councillor, copies often bound in leather. The councillors loved it and Gutteridge was almost always successful in his bids for a contract.

Gutteridge was quick to realise that skilled operating staff would not be available in country towns and that he must produce plants that were simple to operate and maintain, and that if they did malfunction then they did so slowly and without major upsets to the system.

He was conscious of the costs incurred by local governments on behalf of their constituents and he tried to sweep away all unnecessary functions in an effort to develop schemes that would provide the service at reasonable cost.

He believed, for example, that the traditional boundary traps were not necessary, and eventually his point was accepted. Grateful councillors never forgot that he had in this way saved them significant sums of money.

Overall Gutteridge did not always agree with some of the engineering methods and practices laid down by others. One of the consequences was that site testing facilities for pipes were established for each scheme. John Keays spent many hours at Wangaratta establishing guidelines to cover blisters, grazing and other blemishes and sorting out numerous arguments.

Gutteridge would not budge from his standards of piping and it seems reasonable to say that overall, through his efforts, there was a marked improvement in the quality of pipes in both Victoria and Tasmania.

Quality in workmanship was an obsession with Gutteridge. He carried on a continual battle with house connection contractors and was quite ruthless in his demands for efficiency. He used, perhaps unfairly, the depression spectre of unemployment to extract maximum performance for his clients.

He demanded and obtained detailed and accurate job construction records and if he was not satisfied would work with the supervision teams into the early hours of the morning until he knew his staff understood his requirements.

Whilst sewerage and water supply were Gutteridge’s basic fields his agile mind was always eager to accept a new challenge. He designed an abbatoir at Wangaratta and produced designs for major cattle, sheep and pig saleyards.
He was tireless in his efforts to obtain the views of persons expert in new areas and the final design of the saleyards was an excellent example of his ability to assess conflicting opinions and come up with a satisfactory answer.

Gutteridge was a man of wide interests. He was elected a member of the Kew City Council in 1929 and appointed Mayor in 1933-34. The aldermen were surprised but agreed to his request that the council purchase elaborate robes of office, but their reaction to his demand that the aldermen attend council meetings in evening dress was not as well received.

Gordon married Annabel Syme of ‘The Age’ family but sadly the marriage did not last. With two young children, 14 and 8 years, in the family Gordon and Annabel were divorced and each went their way. The children rarely saw their father after the marriage broke up.

Gordon was a rather aloof person. All staff called him ‘Mr Gutteridge’ and were always careful that there was no familiarity on the job.

Gutteridge was a showman and a good one. He purchased a vintage Rolls Royce with front and back seating and, at considerable cost, had it remodelled as a sports car with room for two only. It was a beautiful and eye-catching car, over 20 feet between the front and rear bumper bars and weighed a massive 2 tons. It was hardly the car to drive across the State of Victoria but Gutteridge did just that day after day or rather, as was his habit, night after night. Gutteridge slept little and liked to drive from job to job at night.

The huge Rolls attracted a lot of attention in Melbourne but perhaps none more so than when it was parked in front of the only other car in the practice, a T-Model Ford owned by Bernard Callinan.

Gutteridge’s special joy was to drive serenely along with an attractive young lady beside him. He established a reputation as a ladies’ man and rarely lacked female company when he was relaxing.

Sadly the grand Rolls Royce came to an ignominious end, for a Rolls Royce that is. One evening Gutteridge drove his beautiful car under, of all things, the rear of a brewery truck. He scrambled out of the wreckage, rather shaken, and rang the insurance company from a nearby telephone booth. ‘Come and collect my car,’ he said, ‘it is now yours!’

Gutteridge gained a reputation for meanness, not only to others but to himself. He was certainly frugal with the business side of his money but they were hard times and jobs had a tendency of drying up almost overnight.

In 1933 young John Keays, then a resident of Deniliquin, travelled to Melbourne seeking a position as engineer. He went the round of potential employers without finding a job. Gutteridge was no exception — he did not have a job for him.

Shortly after the interview, with Keays back in Deniliquin, Gutteridge won a commission to design a sewerage scheme for Devonport, Tasmania. He immediately sent a telegram to Deniliquin advising Keays that if he reported to Devonport the following week he would be employed as an assistant resident engineer from the day he arrived there! Jobs were scarce and Keays jumped at the opportunity. Gutteridge saved the firm the cost of fares from Deniliquin to Devonport!
In due course the job was finished with profit to Gutteridge and thanks from the people of Devonport. It had been a very successful project.

On the last day of the job all engineers received a telegram advising them that their employment had terminated. In the case of Keays and Mac Walker, however, there was an addition to the telegram which read something like this: 'If you are passing through Melbourne on your return to the mainland (there was no other way Keays could return to Deniliquin), please call at the office and we will discuss employment prospects.'

In due course Keays and Walker paid for their tickets to Melbourne and arrived at the office of Gutteridge where they were immediately re-employed. Gutteridge had saved the cost of two fares from Devonport to Melbourne! However, to be fair to Gutteridge, he was extremely hard on himself where the firm’s money was concerned. Instead of taking a plane to Brisbane to visit Keays on the Maryborough project, he would sit for three nights and two days on the train from Melbourne and return the same way.

Gordon Gutteridge was a man of contrasts. Austere and aloof, he was incredibly loyal to his staff and would defend them tooth and nail to justify their actions. Afterwards he was wont to say, 'Why the hell did you do it that way? Anyway, come and have a beer and we will work out a way to fix it up.' His genuine loyalty to his staff built a spirit of loyalty between all who worked for him and to their organisation. The foundations he laid in this regard are still obvious today.

Gordon’s ability to crash through twenty-four hours with little sleep often had devastating effects on his young engineers, who found it difficult to match his energy. John Keays recalled one night in the Pinset Hotel in Wangaratta when, with Gordon and the barman, he spent until 3.30 a.m. in the hotel cellar with a keg as a seat, plus one for a radio (wireless, then) and one for a continuous stream of cold pints of beer. The occasion was a description of Bradman and Ponsford belting the insides out of the Englishmen in a Test being held in faraway England.

Keays recalled that it was an enjoyable night but he found it difficult to take levels correctly for three days. Gutteridge was himself a bad sleeper and thought nothing of a five or six-hour game of cards when others would have much preferred to have been in bed.

Gordon Gutteridge suffered badly from the effects of his World War I wounds and his treatment as a prisoner of war in Germany. He never admitted to pain or discomfort although his staff were usually aware, by his very appearance, when his ulcers were acute.

On the outbreak of war in 1939 work on the majority of the sewerage and water supply schemes ceased almost overnight. Many staff members enlisted in the services and Gutteridge was left with an unbalanced organisation and a complete state of confusion regarding his works programme. By hard work and negotiation he diverted the resources of the practice to wartime work in the development of camps and training schools. He subsequently built up a multi-disciplinary organisation which made a substantial contribution to munitions and supply facilities. In 1940 he was
appointed to a panel of engineers, architects and contractors to act in liaison between the Commonwealth Works and Services organisations and the construction industry, and on behalf of this panel he investigated methods of handling the design and construction of camps, training schools and hospitals in the UK, Canada and the USA.

In 1940 he visited the United States in this regard but his health was deteriorating rapidly and after his return he was unable to cope with the multiplicity of problems, which seemed never-ending, in connection with not only the partnership, which had been formed with Haskins & Davey in 1939, but also his war work.

Gutteridge collapsed at his desk on 21 February 1942 and did not recover. His passing was rather sad. His broken marriage had left him very lonely and his constant seeking of companionship never filled the gap of a lost family life. He never really knew or enjoyed his own children, Patricia, David (died in infancy) and Elizabeth.

He was a dynamic man with vision and drive, a hard taskmaster who expected job dedication from his staff and gave complete and absolute dedication himself.

Aloof but likeable, it was almost as if he wanted, but was unable, to break down the barrier between the class to which he had been born and that of the people who worked for him. He was a generous man at times and a scrooge at others but above all he was a capable and dedicated engineer and left his mark on GHD.

Gerald Haskins

Gerald Haskins was born in the 1880s in Christchurch, New Zealand, and to retrace his steps is to step back into the hansom cab era. He was born into a family where Dad’s words were law. His father was a man of some standing; well educated, he was the Town Clerk of Christchurch. His father kept himself very fit, as his children did later, but his brother Guy was considered the top athlete of the family; he was an Olympic runner.

Haskins’ dad decided that his three boys and his daughter should take up the professions of engineering, medicine, dentistry and music. He nominated which child should study which and they did, and all became masters of their own fields.

Gerald was educated at Canterbury University, New Zealand, where he took his degree in engineering and shortly after began working at Lyttelton Harbour. He was of big stature, 6 feet (183 cm) tall and built in proportion. He was full of vitality and had excelled as an amateur boxer at university, was captain of the football team and was one of the university’s top ‘walkers’.

He was restless and found Lyttelton Harbour too small for his liking. He dreamed of the magic of faraway places and considered going to Argentina. It attracted him not only because it sounded romantic and was a long way away — sufficient reasons for any young man to become restless — but because he believed there was such a lot of engineering work to be done in that country that there could be a future for him there.
Gerald's thoughts of Argentina disappeared one balmy night in Christchurch when he was walking Dorothy Staniland home. She was a lovely little sixteen-year-old who had just returned from boarding school at Dunedin. Dorothy's boarding school was the exclusive St Hilda's run by an Order of Anglican Nuns, all of whom had been trained in London as teachers.

The huge Haskins resolved then and there to marry Dorothy and to his question she answered, 'Yes! But Dad will think I am too young!'

That is exactly what Dad did think and the edict was laid down that Dorothy should not marry until she was twenty years of age.

Gerald went off to Sydney to work and each year for the next four years returned to New Zealand by ship during his annual holidays.

In 1913 Dorothy and her mother came to Sydney and stopped at the legendary Petty's Hotel in York Street until her marriage a few weeks later on 14 June at St. Augustine's Church, Neutral Bay. The newspaper account of her marriage is a priceless piece of nostalgia; 'The bride, who was given away by her mother, wore a coat and skirt of pale grey Shantung, hat to match, lined with pale pink and trimmed with grey feathers tipped with pink. Mrs Staniland wore a tailored costume of dark navy blue and black velvet hat richly trimmed with black ostrich feathers!'

Gerald's first jobs in Australia in 1911 were with the Public Works Department at Wagga, then Sydney, and then the Hunter River District Water Board. He made a name for himself in Newcastle, as a dedicated engineer and in their little house in the hills above Newcastle their first son, John, was born in 1917.

Tragedy struck them twice in the early years of their marriage. Their first baby, a little girl, was stillborn in the eighth month of Dorothy's pregnancy following a car accident and the second girl, Betty, contracted poliomyelitis, then known as 'infantile paralysis', and died at eighteen months. Other children, Geoffrey, Phillip and Janet, were born in 1922, 1924 and 1934.

In 1921 Gerald won a job with the Public Works Department as resident engineer for the Avon Dam. The job lasted until 1927.

Dorothy Haskins was genteelly reared, coming from a very comfortable home which supported a housemaid, cook, gardener and groom. The house was set on a six-acre (2.43 ha) block where the Stanilands, who loved to ride, kept their own horses, always in prime condition. Her home was, to say the least, different from the conditions she found in Australia, but she was obviously of pioneer stock. The dwellings at the Avon Dam site were tents, with no amenities. Fresh water had to be carted from the railway and baths were in a large round tub. The hot water was boiled in kerosene tins.

Gerald was solicitous of his wife and after discussion they purchased a small oil stove with three burners and a tiny oven. Most of the other workmen and the one other wife at the site cooked outside over open fires.

Haskins had an extraordinary talent for mixing as an equal with the most humble of his staff. Rough workmen, tradesmen and itinerant labourers all succumbed to his charm and industrial problems were non-existent. He would, however, not suffer shirkers for a moment, but even in this he gained the
respect and full co-operation of a then noted trade union leader, Jock Garden.

The road to the dam was built by eight hundred returned soldiers and Jock Garden suggested to Haskins that with these men it would be difficult to work without frequent strikes.

There were no strikes. Haskins had a reputation for fairness and in the few cases where he was unable to reach agreement with one of the workers over some real or imaginary problem, he sent the aggrieved worker directly to Jock Garden.

One of the most delightful vignettes to come from Mrs Haskins, interviewed in her eighty-ninth year, was that Johnny Goodsell (later the distinguished Sir John Goodsell) was the ‘office boy’ to Gerald Haskins. ‘He was a fat little boy who had never been away from home,’ recalled Mrs Haskins and she reassured Mrs Goodsell that her little boy would be ‘well cared for’.

After the completion of the Avon Dam in 1927, Haskins worked with the Public Works Department and built himself a reputation as a ‘front man’, one who could charm away almost any problem with clients, authorities, contractors or staff. At the same time it was recognised that he was an excellent engineer.

In the late twenties, the engineering sections of the Sydney Metropolitan Water and Drainage Board and that of the Public Works Department were reshuffled with a number of Public Works engineers being transferred to the Water Board. It was somewhat akin to the modern day ‘takeover’ with the same result, a lot of senior men suddenly finding that they were no longer holding the same status as before the merger.

There were no retrenchments but a lot of resentment and even some talk of strikes or, more seditiously, of a ‘go-slow’ period.

Haskins had expected trouble or resentment and he called the higher echelons of the engineering staff to a meeting. ‘I know,’ he said, ‘that there has been a lot of discussion as to whether you would or would not co-operate with me. In short, you have shown a lot of resentment to the changes and I understand your attitude towards me. ‘But,’ he added, ‘it could be possible that of greater importance than your attitude to me could be my attitude to you!’ He then closed the meeting. There were no further problems.

In 1933 Haskins decided to leave the security of the Sydney Water Board and work for private enterprise. He joined Australian Iron & Steel as Assistant General Manager at Port Kembla. At AI & S he renewed acquaintance with Geoff Davey, a younger engineer, and the two became firm friends and remained so after Davey left the firm to set up his own practice as a consulting engineer.

Haskins found it a great trial working at Australian Iron & Steel. He considered management policies to be poor and he worried about what he saw as inadequately trained personnel and extremely poor industrial relations. He chafed under the fact that he was unable to make policy changes in what he considered to be his areas of responsibility. He was particularly concerned at the lack of adequate safety measures for the workmen. He became more
and more unpopular with directors and senior staff for his uncompromising attitude towards poor management procedures and for his incessant complaints of the lack of concern, as he saw it, for safety measures. He finally resigned.

I found some conflicting reports about his resignation. Two sources, one of whom claimed to have been an eyewitness, have sworn that his resignation followed his knocking of a director to the floor of his office. This followed the connection of one of Haskins’ huge fists with the jaw of the particular director concerned. When I talked to his family about this they were aghast. ‘Dad would never do that,’ they said. Well?

Now at the age of fifty years he, the previously highly-appointed engineer, was looking for a job. He approached Davey, one of his former juniors, and asked if he could join him in partnership. It was 1935 and Davey was overjoyed; this partnership came into operation on 19 July 1935.

Haskins worked well with Davey; they complemented one another. Haskins remained a ‘front’ man. He was an excellent engineer but refused to become involved in brawls over technical matters. Davey was the man to solve those problems.

Haskins was of an uncompromising nature with regard to the principles in which he believed and at times his stature was quite awesome.

On one job in a New South Wales country town, John Frew, who had started with GHD in 1937 at Launceston, was appointed as resident engineer during its construction. John was so shocked at the poor quality of workmanship when he arrived at the site that he stopped the job and rang Haskins requesting his presence as quickly as possible. Haskins was there the next day, confirmed that the job should be stopped, and returned to Sydney where he called for an immediate meeting with the contractors, a very large firm.

‘Unless you do the right thing,’ he said, ‘you will never again even tender for one of our jobs!’ Pretty strong words, but he meant them and the contractors knew that he meant them. The contractors dismissed their staff at the site, engaged new construction foremen and from that day became a top construction firm with excellent relations between them and Haskins and Davey.

Haskins had a strong streak of loyalty which probably cost him, personally, millions of dollars from one invention alone.

When he was with the Sydney Water Board he found that the problem of corrosion in pipes was bad. He encouraged W. Tate, an engineer with the Sydney Water Board, to carry out experiments on the matter of cement lining of pipes in situ. It was a masterful piece of engineering and eventually he and Tate formed Cement Linings Ltd to carry out the work, but first they gave the MWS & D Board complete rights to the process. Geoff Davey estimated in 1973 that the work done in the Sydney area alone had saved the MWS & D Board millions of dollars in capital expenditure.

Haskins was a very homely man. ‘He was,’ recalled John Frew, ‘quite comfortable in the kitchens of his staff; he preferred to eat there rather than
in hotels.' He loved nothing better than a picnic with his resident engineers and their wives.

After retirement in 1942, he moved to his farm at ‘Clear Hills’, Oberon. It was pioneering all over again. The cottage was built of pisé, rammed mud and straw, with walls three feet (91.5 cm) thick.

The country could hardly support a bandicoot when he began but he and Dorothy loved it. They were allotted five or six Italian prisoners of war to assist them and they treated the prisoners almost as if they were of their own family. Perhaps, just perhaps, their attitude may have been influenced by the fact that their own beloved firstborn son, John, was during all those years a prisoner of war of the Japanese and of him they had had no news at all. I can understand their worries. I was a prisoner of war in the same battalion and of the same rank as John Haskins; I knew him well.

In 1946, following an operation in Sydney, Haskins’ health began to fail. Solicitous to the end, and comforted by the fact that John had returned from the war, he worried over the long vigils of Dorothy as she sat by his bed. He was concerned for her safety in returning to her lodgings in Sydney each night.

Gerald died on 21 November 1946 — a man who loved life and enjoyed his family, he never had the pleasure of seeing even one of his grandchildren.

Dorothy Haskins, a very gracious lady and much loved by her children, died in June 1985 at the age of 92 years. She was as sharp as a needle to the end. With Dorothy’s passing all visible connections of GHD with the three original partners were severed.

**Geoffrey Innes Davey**

One day some gifted author might write a biography of Geoff Davey. It should be a success but the content would probably cause argument as to whether it were truth or fiction. Davey’s life and his achievements, his idiosyncrasies and attitudes and his overall philosophy, are quite unbelievable. Born in 1906, his life was a teeming period of involvement with people until his death in 1975.

When Davey was almost twelve years of age he told his father that he wished to become a priest of the Catholic Church. His dad, a Catholic, supported the idea that young men should enter the seminary but was quite shaken at the thought that he might ‘lose’ his son. He had had such plans for this boy: tertiary education, a life of achievement; nothing would have been too good for Geoffrey. He talked to young Geoff and was able to persuade him that he was too young at the time to know his own mind. ‘Later,’ he said, ‘you may have a different viewpoint, but if your views remain the same I will not raise any objection.’

Young Geoffrey bowed to the wishes of his father, as young Catholic boys did at the time, and followed the course his dad had planned for him. In 1929 he graduated in engineering from Sydney University and almost immediately was appointed as an assistant engineer with the Metropolitan Water Sewerage and Drainage Board at Sydney. He spent most of his time in that job at the
construction site of the Woronora Dam.

Davey felt limited within the Water Board and left there in 1931 to broaden his experience. He travelled interstate on a variety of jobs and during that period spent some time at Port Kembla as Assistant Works Manager at Australian Iron & Steel. Whilst there he renewed acquaintance with Gerald Haskins, with whom he had worked at the Sydney Water Board and who was then Assistant General Manager at Al & S.

Port Kembla was again too restrictive for the bursting enthusiasm of young Geoffrey. He left there and joined a goldmining operation in New Guinea. Davey loved New Guinea and its people. He saw so much that could be done. Perhaps he would have stayed in that country but he suffered so badly from malaria that, after eight months, he returned to Sydney. Following a period of recuperation he set up his own shingle as a consulting engineer in Sydney.

Consulting engineers were something of an innovation in the depression years. They were born because of the great expansion of public works as an unemployment relief project, and the consequent volume of engineering design was of such magnitude that the engineers employed by the authorities could not cope with it.

Davey had a confidence and charisma that charmed those who met him and his little practice began to grow.

In 1935 Davey married Nancy Hazelton, an architect. They were to have six children. She had been christened Elsie Annette Isobel but from childhood had been called Nancy. She was deeply in love with the young engineer; they had so much in common. They both had mercurial minds and with Nancy an architect and Geoff an innovative engineer, they discussed many problems relating to their relevant professions. Later they designed and built a family home which was, in many ways, thirty years ahead of its time.

It is doubtful if Geoff Davey would have achieved the stature he did had he not had the support of Nancy. Tired and worried, he would return home after a particularly frustrating trip to find Nancy eager to share his thoughts. They would talk until two or three in the morning seeking solutions to some of these problems!

Professional men, particularly those who are perpetually on the move (the engineers of GHD are a good example), need the support of an understanding wife. Davey, in this regard, was a fortunate man.

Nancy Hazelton, witty, beautiful, gracious and clever, was the sparkle in Davey’s life and her generosity extended to all who were fortunate to meet her. John North, a young engineer from New Zealand who had been employed by Davey, contracted tuberculosis a couple of years after he began working for GHD. He told his young wife, Dulce, that he was required to go to the TB Sanitarium at Wentworth Falls in the Blue Mountains of New South Wales. Dulce was devastated. She had no relations and only a handful of friends in Sydney and, at that time, she had two little children — Peter, less than three years old, and Christopher, a delicate baby.

In desperation Dulce rang Nancy Davey. In half an hour Nancy arrived
at the door, collected the little family and installed them in her own house. She placed Dulce and Peter in the children’s wing and looked after the baby herself.

The Norths stayed with the Daveys for some weeks until Dulce regained her equilibrium and decided to go to Brisbane to stay with her sister. Nancy drove them to the railway station but refused to accept any thanks for what she had done. ‘Just pass it on,’ she said to the grateful Dulce, who no doubt did and took the trouble to write to me with this little vignette. Davey was fortunate indeed to have married Nancy.

Perhaps the simplest way to illustrate something of the character of the man is to record the opinions of those who worked with him.

Davey was brilliant with an inventive bent but this trait often caused him to lose patience with his staff and others who were unable to keep up with his vision. He found it particularly difficult to tolerate amateurs or people who did not research their subjects.

At Mount Isa and Mary Kathleen in the middle 1950s, remoteness and other factors meant that conventional concrete dams, as proposed by others for Mt Isa, would have been costly. There were no readily available supplies of suitable material for earthfill dams. Davey, who had been entrusted with these commissions, decided to adopt the approach used twenty-five years earlier at Derby in Tasmania — a rockfill dam with an impervious upstream face. At Mary Kathleen and Mt Isa Davey modified the Derby approach by using ‘gunite’, a sprayed cement-sand mortar, for the face. These are believed to have been the first such dams in Australia. The costs of those dams were substantially less than those of dams of more conventional design, and the dams still stand.

Thirty years later, in a paper to the International Commission on Large Dams, Glen Truscott and Norm Traves of GHD were able to report that with minor maintenance of the face slabs both dams were still performing satisfactorily, and that movements of these dams since construction have been smaller than recorded in the literature for dumped rockfill dams elsewhere in the world.

Which is another way of saying that the dams have been a very good solution to the problem.

Davey has been called an egotistical man but he was not a conceited man. His ego came from the fact that he was able to perceive and solve engineering problems far ahead of most of the engineering fraternity of his time.

Davey could accept a view contrary to his own and with his brilliant mind improve on it but he always gave the credit to the originator.

Ken Inglis recalled that Davey had an answer for everything. This sometimes earned him a lot of trouble with councillors as many of his answers were ‘off the cuff’ remarks made not to solve a problem but to silence councillors. It was left to Inglis, time and time again, to smooth over the resentment which Davey had caused with councillors.

On 1 January 1939 the partnership of Gutteridge Haskins and Davey was formally established. Haskins and Davey had worked and operated
effectively with Gutteridge for some time prior to that date.

Fred Machin, a senior engineer who opened the branch at Canberra in 1966, observed another fascinating side of Davey’s temperament. He recalled that Davey found it difficult to sack staff because of the problems they might encounter in finding other jobs. At the same time he had a great sympathy for ageing people and an appreciation of their worth. He employed older staff to deal with contracts and administration. He found them to be excellent employees and, of course, they responded with great loyalty. Machin mentioned Tom Warren and Jim Nolan as two outstanding people in the older age group.

Davey was in everything. He did not limit his interests to engineering although he played a notable part in the formation of the Association of Consulting Engineers and was President in 1956-57.

Davey was never still and his visits to construction sites were of such haste that the turmoil he created on such occasions often took days to settle down. With a number of projects operating simultaneously in many different areas, time was precious to Davey. Norm Traves of GHD Brisbane, in talking of these flying visits, pointed out that Davey was aware of and very sympathetic to the difficulties of some resident engineers working alone and far from their home office. Difficult decisions sometimes had to be made and Davey preferred the man on the spot to make the decision and, whether or not it could have been made in a different way, Davey always supported his engineer.

On the death of Gutteridge and the retirement of Haskins in 1942, Davey became the sole surviving partner, with full control, and led the practice through the war years. Aware that he would need more engineers and a stable organisation he appointed seven senior staff as associates in 1946. These associates became partners in 1948 but Davey retained for himself the title of Governing Partner.

He was well aware of the need to expand and to accelerate this he appointed Bernard Callinan to be responsible for the Tasmanian and Victorian branches and John Keays, for the Queensland branch.

The pace of Davey’s work was more than most people could have handled but it was said of his engineers and other staff that they were affected by his boisterous enthusiasm and almost always tried to lift their own pace to match Davey’s.

John Frew recalled one instance where Davey arrived at the Brisbane office by plane, drove by car to Maryborough to collect Frew, then drove to Grafton to solve a particular problem. They drove at night, worked during the day and covered 1000 kilometres. On their return to Brisbane, Davey immediately boarded a plane for Sydney. Frew took two days off to recover.

In order to speed up his work Davey, who held a pilot’s licence, purchased his own De Havilland Hornet, but after an experimental period realised that it was more efficient to use a chartered aircraft with a pilot so he disposed of the Hornet. One of the first engineers to appreciate the time-saving benefits of flying to his profession, he calculated, at one time, that he had travelled
over five million kilometres by air while in practice.

Davey was never inconvenienced by change of itineraries. It didn't bother him were he to have proceeded to Deniliquin one day, only to be told that a change of plans meant that he should travel to Hobart instead. It didn't ruffle him so it never occurred to him that it would bother his more conventional staff.

In one instance in 1940, he had engaged John Frew for a job in the Melbourne office at a time when Frew was living at Belmont in New South Wales and working for the Hunter District Water Board. All arrangements had been made; Frew, his wife and a great dog they owned were to drive to Sydney from Belmont in their small car, remain for a couple of days with Frew's in-laws and then drive to Melbourne. On the day that the Frews (and dog) were to leave Belmont, the postman arrived just one hour before their departure time with instructions from Davey for Frew to go to Brisbane and take over a job there. The departure time was adhered to but instead of turning right at the main road, they turned left and began the long haul to Brisbane.

Eric Charles, in 1984 a director of James Hardie, manufacturer of building products and asbestos cement pipes, gathered a clutch of stories about Davey as did apparently everybody who met him. On the agility of his mind Eric Charles recalled Davey suggesting that asbestos pipes would be of great benefit to the water and sewerage industry not only in cost but in maintenance. It was an unheard of suggestion and Davey, knowing that his idea would be unacceptable to the engineering hierarchy, secretly laid a length of main and tested the new pipe. The results are now well known; countless thousand of kilometres of asbestos pipes have been laid in Australia, resulting in savings of millions of dollars to the community.

Davey's incredible personality and his lucidity of speech are revealed in the recounting of many unusual incidents.

Davey was often called to Court to give his professional opinion on engineering matters in dispute. On one occasion in the Supreme Court of New South Wales the learned judge, after all cross examination had been completed, said to Davey, 'What is your final view, Mr Davey?'.

Davey reared himself to his full height and without a blink of an eyelid replied, 'Your Honour, you have no other alternative than to take this course (here he detailed his view) in this case. I am a professional engineer and you are not and I believe that this is the only way this case should go and you would be doing the Bar a disservice were you to find in any other way!' The learned judge sat quietly for a moment then leaned forward. 'I agree with you, Mr Davey,' he said.

And still Davey continued to work at a pace few people could equal. His itinerary was so crammed that he was rarely on time for a function, mainly because he was always loath to break off from his previous meeting.

One hilarious incident at Wagga Wagga, New South Wales, perhaps epitomises both his charisma and his lack of punctuality. The civic fathers of Wagga Wagga had summoned Davey to appear before them at 11.00 a.m.
to explain, if he were able to do so, why he had taken so long in preparing a submission on an electricity transmission line for the Council. It was a serious matter, but, as an afterthought, the councillors had booked lunch at 12 noon at Romano’s Hotel. It would be an opportunity to enjoy lunch with good company after the matter of the delay had been satisfactorily resolved.

By 11.30 a.m., with no Davey in sight, the councillors were fuming and by noon when they repaired to the hotel for lunch, the shire president was apoplectic. His anger was not lessened by the glass or two of mead which was of necessity consumed to assist with the digestion of the meal.

At 2.00 p.m. one councillor arose, requested that the meeting be reopened there and then and proposed that Geoffrey Davey, all his staff, all his offspring and indeed the very name of Davey, be expunged from the records forever. In other words, they should sack him. The proposal was agreed to unanimously.

At 3.00 p.m., just four hours late, Geoffrey Davey walked into the dining room. His presence seemed to fill the room and he began to talk. First he apologised for his late entry; he had been unavoidably delayed. He talked and talked and the councillors were entranced. At 4.00 p.m. they resolved unanimously to appoint Davey as their consultant engineer for a period of five years!

Davey made success a habit and, with his flair for the theatrical, enjoyed his success. In many ways I see him as a little boy with an impish sense of delight in his demonstrations to the groups of VIPs he always managed to attract for his opening ceremonies.

Not that the demonstrations were always as Davey had planned! John Whitaker, who retired in 1984 as a director of James Hardie and Co, recounted this little story to the Local Government Engineers’ Conference in Gladstone, Queensland, on 1 October 1984.

This is how John recalled it:
‘The funniest turn I witnessed which could have been turned into a Keystone Cops movie took place at Mary Kathleen. The township was built complete with water supply and sewerage under the guidance of Gutteridge Haskins and Davey. Geoff Davey, that giant of a man, personally arranged for the commissioning of the water supply and, being the great showman he was, coincided this with a visit by the director of James Hardie, Frank Espie, and other notables.

Geoff invited us all down the road to a demonstration. Sequence of events went as follows: A prepared heap of bags beside the road was soaked with kerosene and lit. Geoff nonchalantly picked up a prepositioned hammer and strolled to a fire alarm. With a flourish he broke the glass and pushed the button and proceeded to make small talk. After ten minutes of chatter the fire started to die down — more kerosene was added. More lapsed time of ten minutes, more small talk, an anxious Geoff looking down the street corner around which the Red Monster was to appear. Fire was now down to a smoulder — more bags added — more kerosene, a further ten minutes. Finally the ring of the fire bell raised
new hopes and around the corner screamed the engine; it stopped opposite the fire with a grinding of rubber and out went the hose from the back of the truck only to find that the hydrant in that direction was about ten feet beyond the reach of the hose.

One enterprising member of the audience helped out by shouting that an alternative hydrant was closer to the front of the truck. After a short debate as to whether to back the truck back or drag the hose forward past the truck, the latter course was adopted. The fire was down to a smouldering whisper of smoke. The beautifully polished standpipe was dropped into the hydrant box ready for the hose to be screwed on and nearly disappeared. It would not reach the hydrant. They had forgotten to fit the hydrant risers. Geoff extinguished the remaining fire by stamping on it and invited all to the wet canteen — there is no prize for guessing who paid. Moral of this tale is: Don’t have a fire engine with a flat battery and no jumper leads.'

In 1964 Davey retired to become Executive Director of the Sydney Catholic Schools Building and Finance Commission, at the request of his friend Cardinal Sir Norman Gilroy. He was responsible for the complete restructuring of the financing and funding of the Catholic school system in New South Wales. How strange that twenty years later, Sir Bernard Callinan CBE, who followed Geoffrey Davey as the principal of the practice, was appointed by the Catholic hierarchy in Melbourne to do the very same job for the Catholic school system in Victoria!

Davey was also a director of both the Mater Misericordiae and St Vincent’s Hospitals and a director of the Catholic Weekly which he managed for some time in his last years.

He planned a world trip with Nancy, a holiday they had looked forward to for many years, but only a few months after his retirement Nancy died suddenly. It was, for a time, like the end of the world for Davey. He was like a man who had lost his way; Nancy had been essentially a part of him and it was difficult for him even to think as he had previously done.

Honours came thick and fast to Davey. In 1966 he was awarded the office of Commander of the British Empire (CBE) for his services to engineering and the community and from 1960 held the Papal honour of Knight Commander of the Order of St Gregory the Great awarded by His Holiness the Pope. The Order was conferred by His Eminence Sir Norman Cardinal Gilroy.

It was a busy life for Davey but without Nancy it all seemed so pointless. Then suddenly he knew what he had to do.

The years dropped away to that twelve-year-old boy whose father, now long deceased, had persuaded him not to seek entry to the priesthood. This time his request was granted. He began studies in 1967 for the priesthood in the Roman Institute for Late Vocations, the Pontifical Beda College.

In May 1971 Geoffrey Davey was ordained a priest in his former parish church, Holy Name Church, Wahroonga, by Cardinal Sir Norman Gilroy, and was appointed as Assistant Parish Priest at Strathfield, Sydney. His six
children attended the ordination.

On 14 February 1975 Father Davey, CBE, KCSSG, BE, MICE, MIEAust, FASCE, died suddenly. He had been active to the very last in a daunting range of projects connected with his Catholic faith. His Requiem Mass was held at the Holy Name Church which had been designed by his late wife and where he had been ordained four years previously. Archbishop James Carroll officiated with Father Richard Davey, Geoff's brother, at the concelebrated Requiem. One of his daughters, Sister Lucy OP, gave the reading for her dad. Geoffrey was buried with Nancy at Mona Vale.

He was a man who has left a legacy of strength and joy behind him. This extraordinary man seemed to teach people wherever he travelled throughout all his life. The stories told about him are inexhaustible and grow with the telling.

He left his mark on GHD, no doubt about that, and on all others, too, who were fortunate enough to meet him.
COMING TOGETHER – PRE WORLD WAR II

The hopes that once we fondly cherished,

The dreams so bright and fair,

Have passed away, in turn have perished,

Like mansions built in air:

‘The Hopes of Other Days’
Henry Kendall (1841-1882)

It is not easy to decide just when GHD began. We have an official date of 1939 but, in effect, that date merely placed a legal imprint on a working relationship already in existence.

Gordon Gutteridge officially established a private consulting engineering practice in Melbourne in 1928 and set up an office in Hobart in 1937 with a Scotsman, Ronald Gordon Gillean, an engineer who had seen service in World War I. Gillean was still in Hobart when Gutteridge died, but an unfortunate misunderstanding between him and Davey led to an unpleasant separation.

Two young men who helped to build GHD were Bernard Callinan and John Keays. They were both graduates of civil engineering from the University of Melbourne; Callinan began working for Gutteridge in 1934; Keays in 1933.

The years prior to World War II were busy ones for Callinan. He was virtually trained by Gutteridge who pushed him into the country, a young lad of twenty-three years, to supervise large water and sewerage projects. Sometimes he was in charge of two hundred men and, without the opportunity of conferring with the Melbourne office, was required to make important decisions on the spot. It was good training for management status.

Geoff Davey began his own practice in Sydney in 1935 and later in that year agreed to the partnership with Gerald Haskins. It is an interesting slant on Davey’s character that, in deference to Haskins, an older and more senior engineer, he named the partnership ‘Haskins and Davey’, not ‘Davey and Haskins’ as one would have anticipated.

In 1936, following the development in New South Wales of the Spooner Plan for assistance to local authorities, Gutteridge was invited by the Haskins and Davey partnership to form an association, akin to a joint venture, under which Gutteridge provided them with engineering design services for sewerage works. Almost overnight teams of young enthusiastic men from his organisation descended in turn on the towns of West Wyalong, Scone, Yass,
Junee and Grenfell and, in a matter of weeks, began turning out complete working designs for sewerage schemes, usually well before the detailed survey was completed.

The three principals were certainly individualists. In this joint venture in New South Wales into which Haskins and Davey had invited Gutteridge, the association was named ‘Haskins, Davey and A. Gordon Gutteridge’. However, when Gutteridge invited Haskins and Davey to work with him later, in Brisbane, this second association was named as ‘A. Gordon Gutteridge, Haskins and Davey’ which was later abbreviated to the present name.

Ken Inglis began as an engineer with Haskins and Davey in 1935 and, as was normal procedure at the time, was sent to the bush as resident engineer for the Coffs Harbour water supply. He was meticulous in his work and it is understood that a fair proportion of the pipes laid under his care were still in the ground in 1986.

In 1936 Haskins and Davey employed the very first of their technical staff, Cliff Brewer, a surveyor. Brewer recalled that the total staff prior to his appointment were Haskins, Davey, Inglis, one ‘Girl Friday’ and Mrs Davey doubling up at home, doing a little drafting between babies and household chores.

Ken Inglis had to turn his hand to a variety of tasks, as most young engineers did in those days. His background as a marine engineer and naval architect was suited to a commission from the Townsville Harbour Board in 1937 for a steel, single-screw, steam tug. Ken designed the tug according to the specifications required by the Harbour Board. They nominated a speed of ‘11 knots in service’ and ‘maximum mean draft not to exceed 10’6’ under the following conditions: bunkers full, ballast tanks full, feed water tanks full, stores aboard and vessel ready for departure.’

The commission was in the name of Gutteridge, Haskins and Davey and the address is shown as 196 Flinders Street, Townsville. The final partnership had not been formed at that time but Inglis believed the name of Gutteridge was added ‘as we (Haskins and Davey) were working with Gutteridge in Queensland at that time’.

Geoff Davey passed the final plans in June 1938 and tenders were called for its construction. Sadly, the tug was never built; the advent of war placed the building of the tug well down on the list of priorities for the Townsville Harbour Board.

Inglis became a very important person in the structure of GHD. He was a senior partner from 1948 after being an associate for two years. After Geoff Davey retired Ken was largely responsible for the administration of the Sydney office and laid down guidelines for the practice which are still in use today.

Gutteridge formed a partnership with Haskins and Davey on 1 January 1937, to operate in Queensland. This partnership was formed because all three partners believed the State of Queensland offered great opportunities. The new partnership of Gutteridge, Haskins and Davey opened an office in Brisbane in 1937 without any commissions or promises of commissions. John
Keays recalled that Gutteridge liked to be on the move and was always seeking to spread his activities geographically. There were other reasons also which persuaded Gutteridge to open an office in Brisbane. His work on the Brisbane water supply and Toowoomba sewerage during his period with the Commonwealth had indicated that, while there were viable consulting engineering practices in Brisbane, only one had any expertise in his field of water supply and sewerage. He saw the opening in these fields and transferred his private secretary, Mrs Annette Rejinders, to Brisbane, placing her in charge.

In May 1937 Gutteridge collected Keays from a job at Yass and took him to Brisbane to negotiate the commission for the proposed Maryborough sewerage scheme. The negotiations were successful and in June 1937 Keays transferred from Yass to Brisbane and began work on the scheme. The Brisbane office was responsible for overseeing the design of the total Maryborough scheme.

Gutteridge’s brother and sister lived in Brisbane and he enjoyed visiting them. His brother, Dr Noel, practised there as a pathologist and his sister, Dr Mary, who had returned after many years of work in the USA, also practised in that city. Mary Gutteridge was a specialist in the fields of child development and child psychology.

John Keays was not paid a high salary for his work at Maryborough, twelve pounds ($24.00) per week and, although it is all relative to the time, the salaries paid to four cadets transferred from the Melbourne office, four pounds or five pounds per week, seem even from this distance to be very low.

Keays was later responsible for the engineering of water supply and sewerage schemes in over thirty cities and towns in Queensland, for hundreds of miles of rural highways and shire roads, plus a wide range of civil engineering works.

At university John was prominent as a sportsman and was awarded a University Blue for athletics. Looking at his career of forty-one years service and the States for which he was responsible for most of those years — Queensland and the Northern Territory — it is suggested that his capacity as a long distance runner would have been well tested.

John Keays rose to a position of eminence in the consulting engineering field, particularly in Queensland. He was made a Member of the Order of the British Empire in 1973 for his services to the profession of engineering.

He remained active after his retirement from GHD in 1974 and established a high reputation as an engineering arbitrator. He was made an Honorary Fellow of The Institution of Engineers, Australia, an Honorary Life Member of The Association of Consulting Engineers Australia, and an Honorary Fellow of The Institute of Arbitrators Australia. The new boardroom in The Institution of Engineers’ building in Brisbane has been named in his honour, following his death in 1985.

Some interesting industrial problems arose on the Maryborough Scheme prior to World War II. With the spectre of unemployment always a bad memory from the Depression years, the Council decreed that day labour only
be used (six hundred men at one stage) and that all excavations be done by hand. The trade unions were on hand to inspect every piece of equipment, even windlasses hauling buckets of earth, to ascertain whether the machines were ‘putting men out of work’. The use of a horse-drawn scoop was condemned by the councillors as ‘mechanisation’ of the job, but the ultimate was probably reached in the refusal of the Council to allow the purchase of one, one only, concrete mixer for concrete foundations for the sewers.

In discussing the proposal to purchase the mixer, one of the aldermen, probably more affluent than the rest, loudly proclaimed that he only wore handmade suits because ‘there is no comparison between a suit which is carefully made by hand and one stitched together by machines’. ‘It is the same with concrete’, he said. ‘How could one compare the quality of concrete mixed three times on the board with concrete rolled around in a mixer’!

Jim Trench joined Keays (like himself recently married), after a few months in 1937 as a surveyor on the Maryborough sewerage scheme and his great frame appears and reappears throughout the history of GHD. Jim had been in practice for himself prior to joining GHD and had had a stint with the British Phosphate Commission at Nauru and Ocean Island. Jim Trench helped to build the survey team of GHD into the largest private survey practice in Australia. He retired in 1971.

In June 1937 George Kerr, an engineer working for Haskins and Davey, was transferred from Sydney to take charge of the Brisbane office. Kerr remained there until March 1939 when he was transferred to Adelaide to open an office for the now established practice of Gutteridge Haskins & Davey. The Adelaide venture was unable to make progress due to the outbreak of war and the office was soon closed.

In 1938 the first joint venture was extended to cover a regional water supply scheme to be known as the Southern Riverina Water Supply Scheme, serving communities to the south and west of Wagga Wagga in New South Wales.

It was, to say the least, a very confusing situation. There were now two joint ventures in operation and staff were interchanging between the two practices and the two joint ventures. In 1939 it all came together with the legal formation of the partnership of Gutteridge Haskins & Davey, Consulting Engineers.

One of the most interesting people to stalk through the prewar scene of GHD was Richard Vowell, an engineer of note retired from government service in New South Wales. George Goiffin, an engineer with GHD in those years, recalled pleasant memories of this fine old gentleman.

Vowell was in his seventies but for all that was an imposing figure of great height with a flowing shock of hair. He stumped around with his stick and was treated with the respect of royalty by heads of government departments in both New South Wales and Queensland. He advised Haskins and Davey and their engineers of methods of approach to various instrumentalities and authorities.

His name crops up frequently in minutes of meetings of partners where
he was present, although he was not a partner, and in cash books recording where he was paid, but he was not an employee. It would be unfair to label him as a precursor of the modern day lobbyist, because the latter word has overtones of seediness or intrigue now, but he was, in fact, a person whose knowledge of people and procedures in government places was of immense value to GHD.
The diggers are digging, and filling the hole,

They’re sighing and sighing,
They pray for my soul,
I hear what they say, and from where I am lying,
I hear a new corporal calling the roll,
But the diggers dig on and fill in my bed,
The diggers dig on, and they sweat and they sweat,
They sigh and they sigh, and their eyes are wet,
The brown earth clatters and covers my head,
Then I laugh and I laugh, for they think I’m dead.

'The Diggers'
Leon Gellert (1892-1977)

The outbreak of war in 1939 had a profound effect on GHD as it did on every phase of Australian life. Involvement in World War II caused an almost complete halt to many engineering projects in Australia including some then under construction or being planned. In the local government field, for example, water and sewerage schemes were almost entirely halted. GHD was not alone with this problem but it was able to switch its experience to assisting the country’s war effort. The variety of projects in which GHD was involved brought about an increasing emphasis in structural, mechanical and electrical engineering.

There were also during the war years severe constraints imposed on designs because of the limited resources which were available. This in turn was a challenge to Davey, a master of improvisation and ingenuity; the results required were usually achieved despite the problem of restricted resources.

The variety of work in those years included the design of laminated timber structures for aircraft hangars; petrol-electric and petrol-hydraulic operated cranes for use by the Armed Services; hydraulic pumps and accumulators for almost every munitions factory and pyrotechnic plant built in Australia; semi-automatic shellheading presses with their associated hydraulic equipment and controls; retorts and fractionating columns for the shale oil industry; mobile welding and generating plant for a wide variety of uses and the establishment of a ship repair and ship building yard for small ships at Port Kembla.
The late Sir Howard Beale, in supporting a toast to Sir Bernard Callinan on the occasion of Callinan’s retirement in 1978, made a special point of touching upon the efforts of GHD during the 1940-46 years. He said, ‘I was associated with the firm in a wide variety of defence equipment projects. For example, semi-automatic hydraulic shellheading presses, mobile cranes, bitumen heaters, fuel storage tanks, aeroplane hangars, machine tools, ship degaussing equipment, ship repairs, small defence craft, shale oil plants, food processing equipment.’

The effort was a mighty one and Davey applied all his inventive genius to improving the design of the machines in use. Fred Machin, who had joined Haskins and Davey as a mechanical engineer in 1937, made a significant contribution to their involvement in the production of war equipment. He became a partner in 1949 and retired in 1966.

The total involvement of the practice in the war effort is well illustrated by the situation in the Melbourne office at that time.

Gutteridge was extremely patriotic and would have preferred all civil works to have stopped in favour of direct participation in the war effort. This was impractical and some civil works were continued but the male staff — Mac Walker the senior engineer, Charles Murphy, Cliff Brewer and Aub Holdsworth — all sought release from their jobs to allow them to join the services. In fact, the entire male staff of the Melbourne office, whether working in Melbourne or in the field, joined the services. Gutteridge applauded the rush to the colours although it left only himself and R. G. Gillean, both World War I men, and Mrs Benedict, to run both the Tasmanian and Victorian branches.

In an effort to assist the maintenance of the Melbourne office, Davey transferred two very young engineers, Philip Scott and Bill Elliott, to the branch but Gutteridge immediately seconded them to Sydney Bell and Associates to work at the Maribyrnong Munitions Works.

Scott was a mechanical engineer and one of his first tasks was to accept equipment, shipped from Germany prior to the outbreak of war, for the manufacture of sulphuric acid. He and Elliott continued to work with Sydney Bell and Associates until 1942 when Gutteridge died and Scott was told by Davey to return to the Melbourne office as manager. Elliott remained at his munitions work.

Philip Scott was a very young engineer with little experience of any kind, particularly in the administrative sphere. He spoke fondly of Mrs Alma Benedict and with gratitude for the assistance he gained from her. She was the major-domo of the Melbourne office or, as Scott said, ‘She was the office!’ Mrs Benedict was one of those fabulous people who regarded everyone as being of her own family. A very private person; nobody knew who or where the Mr Benedict was and nobody enquired. She not only capably managed the southern region of the company but was able to find the time to write to all the young men of GHD who were away at the war, sending them parcels and gifts on a regular basis. She was appreciated and loved by all who were privileged to meet her.
Scott recalled that the office was never short of design work. They designed the conversion of barges into hospital ships and even carried on with the design of civil works where such works were relevant to the defence effort.

One such job was at Scottsdale in north-eastern Tasmania, where the town water supply had to be enlarged to cope with water used by a planned food processing plant for the supply of dehydrated vegetables to the Armed Services.

After the cessation of hostilities, Bernard Callinan returned to Melbourne and took over from Scott as manager for the southern region which still included Tasmania and Victoria. In a world, then as now, where power and politics are a part of big business, it is refreshing to hear that Scott automatically relinquished his prestigious job as manager because he realised that Callinan was senior to him. (Scott remained with the Melbourne office for some years before transferring to Brisbane, where he worked on the mechanical engineering side of Queensland hospital projects. He left GHD in 1959 to start his own practice and by 1984 had retired from consulting engineering. After his retirement he retained a keen interest in hospitals and was appointed President of the Royal Flying Doctor Service.)

The Brisbane office also had its share of ups and downs during the war years.

George Kerr, who was transferred to Adelaide in 1939 to open a new office there, was temporarily replaced as Brisbane manager by John North. A New Zealander, North had been working as an engineer in the Sydney office. He had handled the design of a one-million-gallon elevated reservoir which had been programmed at the time of the Maryborough sewerage scheme being constructed under the supervision of John Keays, who was in Maryborough at the outbreak of World War II. At the Easter season in 1940 Keays left there to formally take over from North as Brisbane office manager.

The Brisbane office maintained its share of local commissions. The Maryborough scheme was still under construction, work was in progress for the Burrum Shire and road and sewerage works were in hand in the Grafton district of New South Wales.

The two engineers, Keays and North, found the workload too much at times and enlisted on a part-time basis E. F. Gilchrist, who had for many years been Brisbane City Council Engineer. The balance of the staff was not numerically large — one draftsman, a cadet and a typist. Later in 1940 when Keays had to leave Brisbane for the Melbourne office, North took over from him again but, sadly, developed tuberculosis in 1941. Lew Thomas took over from North but later left and was replaced by Rex Anderson who, at that stage, had not obtained engineering qualifications. Rex held the job as manager until Keays returned from war service in 1946.

John Keays had begun working for Gutteridge as far back as 1933. Civil engineering was declared a reserved occupation and engineers could only enlist if they were engaged in non-essential civil works and had the employer’s release. Davey refused to give Keays a clearance until December 1940. Davey believed that there was so much work in the field of engineering to support
the war effort that engineers would be wasted in the Services.

Keays joined the RAAF in January 1941 and directed the construction of airfields in Queensland, Northern Territory, New Guinea and Tarakan. One airfield constructed at Kiriwina was notable as being the first airfield to be constructed using coral as the pavement material.

In 1944 Keays was Commanding Officer of No. 1 Airfield Construction Squadron reorganising at Randwick Racecourse in Sydney. One of the recruits was a young Pilot Officer, Norman Traves, fresh out of university. Traves was posted as a Works Officer. Keays liked the look of the lad and was impressed with the quality of his work.

Keays took his squadron and Traves to the Islands and finished active service at the end of the war at Tarakan; Traves finished the war as a Flying Officer. Shortly after the war Keays offered Traves a job with GHD. Until Keays retired in 1974, he had been virtually Traves’ boss for the whole of Traves’ working life — and his special friend!

GHD was fortunate in appointing Albert Streber to its staff in 1940. Although he considered that credit for the maintenance of GHD as a viable concern during World War II should go to Geoff Davey, Streber was a tower of strength. He was a refugee from Nazism and came to Australia early in 1939. A graduate of Munich University in electrical and mechanical engineering, when he arrived here he was immediately employed at Morts Dock. His fiancée arrived from Belgium in June 1939 and they married immediately but on the outbreak of war Albert’s position at Morts Dock became over-sensitive because of his nationality. Hence he applied to and was employed by Davey. Albert worked long hours during the war years and his skill and dedication were such that in 1954 he was made a director of GHD. He retired in 1977 after thirty-seven years service, and died in Sydney in 1986.

Geoff Davey made both the services and staff of GHD available to the Commonwealth for defence projects. One of the first requests from the government was that Ken Inglis, who had joined GHD as a shipbuilding engineer and naval architect, be seconded as a civil engineer to the American Army. He worked on various projects but mainly water supply for the American Forces.

One of Ken’s major jobs was in Port Moresby, to where he was called by MacArthur’s staff at the request of US Colonel Lehr. His task was to ensure that the US 5th Air Force in that area be provided with adequate water — and they were.

Inglis told one little story of Geoff Davey which is worth recording: ‘Davey knew everything,’ he said, ‘and if he were told that the sun would rise in the morning he would prove, absolutely, that it could not do so!’

The enlistment of Jim Trench, who was in charge of surveying, reads like a French farce. Trench enlisted in the air force at Melbourne and was appointed an officer on enlistment. On that day the air force hierarchy had planned to send a senior man north to design and build a ring of airfields around Townsville to be used by the expanding US Air Force. Unfortunately the officer who had been selected to go was sent elsewhere, so Jim was sent
in his place.

When Jim had signed all his attestation papers and passed into the Quartermasters Store, there was not a uniform to fit him. They were grim days in 1942 and all equipment was scarce but under no circumstances could a senior air force officer be sent north without a uniform. Jim was a very large man and the Quartermaster suggested that he try on the uniforms which were hanging on pegs along one wall. 'They belonged to pilots who have all been transferred to the RAF,' said the Quartermaster. 'They left in a hurry'.

One of the uniforms fitted Trench, at least in most places, and that night he was on his way to Townsville. He had not been given the usual six weeks rookie course and consequently not only did not know whom he should salute but how to salute. He had never been in a plane nor on an aerodrome in his life. How did we win the war?

Jim built his aerodromes not only in North Queensland but in New Guinea and Borneo. He rose to be Commanding Officer No. 4 Airfield Construction Squadron. Jim returned to GHD after his discharge from the Services and retired as a partner in 1971.

The war effort of Bernard Callinan is not so much a part of the history of GHD as a part of the history of Australia.

Callinan enlisted in the Services in June 1940 and graduated from the Army Headquarters School of Military Engineering at Liverpool, New South Wales. Shortly after his graduation he was selected for special service attached to British Military Mission 104 which came to Australia to train 'Independent Companies'. These groups were later renamed as Commando Squadrons and were trained on Wilsons Promontory, Victoria.

On completion of his training, he was posted to the 2/2 Independent Company which, after a period at Katherine, Northern Territory, proceeded directly to Dili in Portugese Timor as part of the Australian defence against the southern thrust of the Japanese.

When the Australian garrison on Timor surrendered to the Japanese in 1942 the guerillas took to the hills, just three hundred of them originally but about one hundred more managed to avoid the surrender at Keopang and joined up with the Independent Company. Over a twelve-month period of classic guerilla warfare, the commandos outfought a garrison of up to ten thousand Japanese soldiers at a cost of forty-seven casualties to themselves, but one thousand five hundred to the enemy. This small campaign caused the Japanese to divert two army divisions to the north-west at a time when the fighting in New Guinea was at its fiercest.

It was one of those odd coincidences which happen in war that Charles Denis Murphy, who had worked with Callinan in the Melbourne office, turned up as a platoon sergeant in Timor, under Callinan. Murphy landed there with reinforcements to the 2/4 Independent Company. He was later an instructor at the Australian Staff School.

Callinan eventually commanded the Australians and when the inevitable evacuation was made, he made one last appeal on the night of the evacuation that he and a small party of about fifteen men be allowed to remain on Timor.
Permission was refused and he was evacuated with troops under his command. Callinan later commanded an infantry battalion in Dutch New Guinea and Bougainville.

For his efforts in war for Australia he was awarded the Distinguished Service Order, the Military Cross and was Mentioned in Despatches.

The effort of GHD during World War II was total and perhaps may be best illustrated by Davey’s letter to all staff written in January 1944. ‘I am thankful to every one of you for the effort which you have made in recent years. I remind you that it has been for the good of achieving the job and not for monetary gain. We can be proud of the results of the last four years and few groups of similar size and character can point to so much achieved.’

Davey’s policy on the ‘cost plus ten’ system of remuneration by the government was of such meticulous honesty that many war jobs accepted by GHD were completed at a loss. Davey refused to include extraneous costs and in his letter to the staff he explained, ‘a great volume of work has been done without any remuneration to the firm’. John Keays, a long-serving director and later Deputy Managing Director of GHD before he retired, confirmed this extraordinary situation that many projects connected with the war effort involved GHD in financial loss.
Van Diemen’s Land

Warmth in July like first clear days of spring,
    and sunlight glints in mirrors, windows, pools;
the heat hangs in the garden like a stare.
The light is still abrupt with winter’s sting
but change is upon us; change is everywhere.

‘Warmth in July: Hobart’
Vivian Smith (1933 - )

It is as difficult to fix a starting date for GHD’s first involvement in Tasmania, as it is to fix the actual commencement of GHD.

It was in 1924 that Gutteridge, then Director of the Sanitary Engineering Division of the Commonwealth Department of Health, served on a Royal Commission established to review the water supply to the City of Hobart. He submitted a number of reports relating to the various alternative sources of supply.

In 1930, in his capacity as consulting engineer, Gutteridge reported to the City of Hobart on the suitability of the Derwent River as a source of water supply. Recommendations of that report were implemented thirty-three years later in the form of the present Bryn Estyn Offtake and Treatment Works.

In 1933 Gutteridge, who was working on the Devonport sewerage scheme, employed two young Melbourne University graduates to assist him; they were E.McD. (Mac) Walker and John Keays. Almost immediately Gutteridge appointed Keays as project manager for the scheme.

When Mac Walker and Keays returned to Melbourne, Walker was appointed manager of the Melbourne office and Keays was placed in charge of the Wangaratta sewerage scheme. Keays was later sent to Brisbane and Mac Walker went off to the war. Walker did not return to GHD after his wartime service but joined the Victorian State Rivers and Water Supply Commission.

Bearing in mind that Gutteridge began working in Tasmania in 1924 and opened an office in Hobart in 1937 under the management of Gordon Gillean, it is still difficult to fix the commencing date of the partnership in Tasmania. However we know that the Mt Paris Dam, comprising a concrete slab buttress 15 metres high and 82 metres long, was designed by Geoff Davey in 1936 and that Geoff had been superintending engineer for the construction of the new Cascade Dam at Derby in 1934; both dams were for tin mining.

In 1937 Gordon Gutteridge designed and constructed a water scheme for the townships of Beaconsfield and Beauty Point, taking the supply from a non-perennial stream, Anderson’s Creek, and making use of an old mining dam. This trait of making use of available materials and resources has been
a feature of GHD’s approach for more than fifty years and has resulted in many jobs being completed — economically too — which otherwise might not have been done at all. (Two classic cases of this type of resourcefulness were the rockfill dams in Queensland at Mt Isa and Mary Kathleen and the tramway for the Upper Burdekin where some of the rails used were one hundred years old!) The pipes for the Beaconsfield schemes were reinforced concrete and, to save money, were designed and built, as regards pressure-strength and diameter, with just as much as was needed for their position — no more, no less — so that in Beaconsfield water engineers can be confronted by not only nine and eight inch (225 and 200 mm) pipes, but seven, six, five and four inch pipes as well!

In 1938 Gutteridge prepared a major report for the Hobart City Council on the numerous sewage discharges into the Derwent River and the effect of this on the beaches. When war was declared in 1939 he was preparing a physical model of the Tamar River, the lovely estuary at the northern end of the island; this work was later carried out by Ken James in Launceston.

Other projects were designed and managed at that time. Works were designed for the Marine Boards of Launceston and King Island and a complete new ‘Ovaltine’ manufacturing facility at Devonport was designed and commenced in 1940 and was completed by 1942 by the Sydney office of GHD, the Melbourne office at that time having virtually ceased to exist. This was
an early example of project management of a multi-disciplinary industrial project, GHD being responsible for all aspects of the development including building design services and, to some extent, process plant and equipment. The manager of the Ovaltine factory was an Englishman, Rodney Stone, who became a lifelong friend of GHD.

In the immediate postwar years when materials, equipment and qualified staff were all in short supply, GHD continued to increase its contribution to the development of Tasmania. Increased government spending within the State on health and education services prompted GHD to expand the practice to include all disciplines associated with engineering, surveying and planning and since the 1960s it has served both government and private clients in all fields of engineering.

When in 1946 Bernard Callinan was appointed in charge of both Tasmania and Victoria, he had come to a practice which had virtually collapsed with the enlistment of all its engineers in the services and the death of Gordon Gutteridge in 1942. By prodigious personal efforts he built up the practice again. For some three years Bernard went across Bass Strait to northern Tasmania for one week in every month; he scurried around on municipal inspections, wrote reports, attended meetings and climbed into a homeward-bound DC3 on Friday night. His tales of life in Tasmanian country hotels then are legendary. Much of the later expansion was the result of his management policies and his appointment of the most suitable staff to apply not only their own particular expertise in engineering but also in the extremely important areas of management and public relations.

In 1947 GHD opened a permanent office in Launceston in the north of the State under the management of John Frew, who had returned to the firm after working for some years with the Brisbane City Council.

John Frew was a Scotsman but, in contrast to Alex McPhedran of Hobart, another of Gutteridge’s staff, John was a quiet academic engineer. He attended to the postwar development rush of a dozen or so municipalities in an efficient manner. The two offices of Hobart and Launceston were only 117 miles (187 km) apart but for many years were run entirely separately, Launceston controlling the northern and Hobart the southern part of the island. John Frew finally left GHD in 1950 and was replaced by Alan Strom who had been working in Central Tasmania.

Strom had joined GHD in 1947 and had been enjoying a relaxed and entertaining life as a young bachelor engineer but suddenly found that life was real and earnest. To inspire him to greater endeavours, Melbourne office wrote to him saying that, as his posting to Launceston was now permanent, he would no longer be paid ten shillings per week living-away allowance and his pay would thus revert to fifteen pounds a week. He employed a sixteen-year-old, Don Cameron, as a cadet engineer, making a staff of two. Cameron was appointed manager of the Hobart office in April 1970 and was made a principal of GHD in July 1981. The Launceston and Hobart offices were finally united under one command when Strom moved to Hobart in 1959 after the untimely death of McPhedran.
In 1943 GHD built a small water treatment plant to purify the water for Beaconsfield and Beauty Point. It was at this plant that the initial techniques for treating the coloured water peculiar to some areas of Tasmania were developed.

The small councils which were scattered throughout Tasmania generally did not run to the employment of a municipal engineer and staff; they just couldn’t afford it. Instead, with complete confidence in the integrity of GHD, more and more councils appointed the firm as consultants to carry out virtually the total engineering work in their municipalities. These arrangements lasted for many years and still remain in several municipalities. The system was so successful that in the forties and fifties GHD carried out considerable investigation, some design and a fair degree of supervision of construction work on water supply and municipal sewerage schemes for nineteen of the thirty-four municipalities in Tasmania.

White Hills Wastewater Treatment Plant.

This ‘grass roots’ relationship was fostered by GHD’s Hobart manager, McPhedran, and continued after his death by Alan Strom and David Skillington. McPhedran had been appointed manager of the Hobart office in 1947 following the premature death of the previous manager, Mick Hansford, a survey draftsman. The appointment in 1946 of Bernard Callinan as partner in charge of both Victorian and Tasmanian operations for GHD further strengthened this attitude of working closely with councils. GHD’s relationship with local government still exists today. Alan Longstaff, who joined GHD in Hobart in 1949 as a cadet engineer, recalled with pleasure the ‘family’ feeling when dealing with council and shire staff and with the
councillors. Alan was appointed a director of GHD in 1978.

Except for a short time during World War II and during the immediate postwar years, the offices have been maintained and have continued to grow. The reason for the temporary closure of the Hobart branch during World War II is one of which GHD may even be a little proud; all the male staff enlisted in the Services!

Gordon Gillean, whose musical accent hinted at his Scottish origins, managed Hobart until 1942, when he resigned after a serious disagreement with Davey. The small office was then managed as best as possible, for the remainder of the war years, by a young trainee, Ken Smart. Ken was seconded from the Melbourne office and was replaced by Mick Hansford in 1946. In 1947 McPhedran took over the job as manager. Alex McPhedran, bluff, charismatic and anecdotal, with his own unique brand of humour, had arrived in Australia from Scotland in 1912. He would appear on the doorstep of a client with his battered hat and a Mac-something tartan scarf wrapped loosely over him and barrage the delighted inmate with pithy and apt greetings delivered in a Scottish accent. He was on first name terms with dozens of public servants, council clerks and councillors throughout Tasmania and his approach to them won their interest and confidence. Don Dudgeon, Council Clerk of Clarence, was an example. He used to say that a friendly clash with McPhedran livened up his day.

Alex’s great recipe for his humorous sallies was his cultivated ‘Scottishness’. He bought a new car after much negotiation. It was a Ford Prefect, a simple car in all respects but with a tendency to overturn if pushed and a weak gearbox, yet with a good engine. Alex had immediate trouble with his new car, only partly the fault of the manufacturer one suspects, and after many shouted phone calls he won his argument with the company by threatening to drive around Hobart with a sign on the car ‘Genuine Ford Prefect, Beware of Flying Parts.’

There was a great need for surveying in the State in the early days of GHD and Alex told the tale of being caught in a remote little town one night, dog tired, with his surveyor, a huge man. They settled on the only room available in the town, in a cottage doubling as a boarding house. The room contained no modern facilities and one ‘three-quarter’ bed which Alex had to share with his giant surveyor.

One feature of family life for the engineers which looks laughingly old-fashioned nowadays but one which prevailed not just in Tasmania but right across GHD in those formative years, was the importance of the supportive wife who could handle not only the children or the house repairs but also night-time phone calls from irate ratepayers or contractors. She had to keep the children quiet when daddy was working and things weren’t going too well and remind him of their ages and even their names when necessary.

Geoff Davey liked to stop with the McPhedrans whenever he visited Hobart. He delighted in the rough brogue of the Scot; it seemed to deepen each year as did his blunt and boisterous manner. Davey found almost sinful pleasure in being spoiled by Alex’s wife Daphne, who gave him his breakfast.
in bed whenever he stopped with them. Davey, who could handle the work of any two men and look for more, was in real terms a very simple man.

In 1958 David Skillington was seconded by GHD to the Municipality of Clarence, then a sleepy little dormitory suburb of Hobart. Skillington, who was working at Mt Isa at the time, packed his little family into his old car and drove from Mt Isa to Melbourne, then transshipped to Tasmania.

Until the old floating bridge across the Derwent was opened in 1943 the only access to the suburb from Hobart had been by ferry. The opening of the bridge made rapid expansion possible and by 1960 the population had jumped from 2000 to 20,000 and was still increasing.

The ramifications of population explosion on municipal services were enormous. Domestic water supply went from tanks to properly engineered town water supply with reservoirs, underground mains and storage dams; sewerage went from backyard closets and septic tanks to reticulated sewers and treatment plants.

Expansion did not stop there with water and sewerage; roads had to be rebuilt and sealed and kerbs and gutters installed; drains were changed from smelly earth ditches polluted with sullage to piped underground drains, and new subdivisions were designed and developed. All of this was engineered by GHD.

In 1961 GHD actually assisted the Clarence Council (or Commission as it was then) to select and employ an engineer. The Clarence Council now has a substantial and excellent engineering staff. Such has been the relationship of GHD with Clarence Council that they still engage GHD for major items which are beyond their expertise or beyond their capacity at the time.

The Brighton Council, north of Hobart, later followed suit. Councils of Launceston and GHD have maintained a similar relationship. Beaconsfield and Riverside, another growing suburb of Launceston, have all their engineering done by GHD to this day.

In 1959, after Alex McPhedran died at the age of fifty-two, Strom moved to Hobart and Roger Phillips took over the running of the Launceston office. Also at this time Crofton Hatsell, who had worked with McPhedran, took over a lively office at Devonport from John Murray. Several years later, when Roger Phillips moved to Melbourne, Crofton was moved to Launceston. In 1971, Ken Tabart was appointed manager.

One aspect of surveying can still bring a rather wry smile to the faces of the senior partners in GHD when they recall their big Tasmanian ‘take over’. When the biggest surveying practice in Tasmania came onto the market GHD was ready for expansion in this area and the large practice looked to be a good proposition to Bernard Callinan, who was then responsible for GHD operations in Victoria and Tasmania, and to Jim Trench, the partner in charge of surveying.

Negotiations for the purchase finally settled on the then large sum of five thousand pounds. The whole deal was beautifully stage-managed in the owner’s elegant loungeroom-cum-study. Deep leather armchairs, polished wood and lots of imported Scotch served in Waterford crystal — it was quite
a night! The venture did not realise the anticipated results. On examination of the internal workings of the surveying firm (after the deal was completed), it became clear that almost all of the practice was managed by one surveyor who liaised with the more important of the clients. This surveyor left the firm two weeks after the deal had been signed and took all the clients with him!

GHD in Tasmania was quite often appointed to supervise the construction of a project in addition to preparing the design. Their reputation for meticulous work in the matter of project management earned them the regard of many of the councils and authorities, who were aware that not only would projects be completed on time but almost always completed within budgets.

One project in Tasmania, the construction in 1959 of the wharf facilities at Devonport for the new Princess of Tasmania, almost reads like a comedy script. GHD did not design the wharf but was called in to handle the project by Rodney Stone (Ovaltine Manager) who was also the Master Warden of the Devonport Marine Board. Stone wanted to ensure that the wharf would be completed in time for the inaugural visit of the ship and the official opening of the terminal by the Premier of Tasmania, the Hon. Eric Reece.

John Murray, who was project manager, recalled that there was continuous and almost feverish activity with the proposed opening date one day attainable and the next day, when even a minor setback occurred, completely impossible to achieve.

The construction company which had worked in the most outlandish places, including China, was a blueprint for unorthodoxy. The accountant of the company was one of the operators of a pile driver, the managing director was the chief foreman and his father was the chairman of directors.

Everybody on the job knew what had to be done. The owners had laid down stringent penalties were the opening to be delayed. One thousand pounds per day would be charged to the contractor for each day’s delay. On the other hand, incentives were provided in the way of one hundred pounds per shift for every shift which was completed when ten points of rain fell during the period of the shift. There appears to be little truth in the rumour that before each shift the chairman of directors assembled the construction gang and led them in prayers for rain (ten points only!) for the shift.

The wharf which had been a beehive of activity was completed on time and, amid loud cheers and ribbon cutting, the Premier opened the wharf as the Princess of Tasmania displayed her wares. Murray and his staff went home to sleep.

The Launceston office, which was at that time under the direction of Alan Strom, was very busy. In addition to the wharf project John Murray was looking after two sewerage projects at Ulverstone and Latrobe. He recalls that sleep was a luxury which GHD staff could not afford at that time.

In the late 1950s GHD purchased the Sydney R. Bell practice in Melbourne, with clients in Tasmania. The practice was weighted towards mechanical and electrical engineering and opened new areas for GHD in Tasmania.

Douwe de Haan joined the Hobart staff in 1960 and Don Skinner, an
electrical and mechanical engineer, in 1961. Clients came in very quickly. Initially the commissions were from previous association with civil engineering for local and State governments. When the government realised that there was a firm in their own capital city prepared to undertake building services work for hospitals, schools and for the University of Tasmania, they responded with a ready supply of jobs. A civil engineer in Hobart was heard to say in 1959, ‘It is raining jobs and none of them civil.’

The electrical and mechanical work expanded in Melbourne to such a degree that in 1970 Don Skinner, the leader of the discipline for GHD in Tasmania, transferred to Melbourne to take on the challenge of the larger market.

David Skillington was appointed to the position of manager of GHD Tasmania, in 1969, taking over from Alan Strom.

Between 1960 and 1975 water supply was introduced or augmented to some forty towns in the State and sewerage schemes were initiated or extended to approximately twenty districts. Major works included the West Tamar water scheme, the Hobart water treatment plant, the North Esk water treatment plant, Risdon Brook Dam and Curries River Dam and reports on the development of a North-West regional water scheme, the Longford-Cressy irrigation scheme, Warners Creek Dam and the Huon Region irrigation scheme.

The State’s engineering bureaucracy, to which all water and sewerage projects had to be submitted for approval was (and is) small compared with other States but the level of individual competence was high. After they gained confidence in the GHD engineers, they kept only a loose rein on their engineering activities and afforded help and encouragement when necessary. This climate enabled GHD to carry out many innovative and cost-saving schemes, more so than was possible in other States both then and now. Those State engineers over nearly forty years included Bill Ritchie, Joe Dobner, Col Collins, Bernard Monks and Dennis Schaffner, all competent and experienced men. However, the chairman for a number of years, Arthur Rowe, was not
an engineer but an accountant by profession. His enthusiasm to get major water jobs done often led him to take an executive decision and work directly with the GHD engineers. Sometimes he would ring for off-the-cuff advice on the best solution for some engineering problem with which GHD was not even involved!

The Chief Government Architect, on his retirement in the late 1960s, said that all the north-west coast hospitals, New Norfolk and the Royal Hobart Hospital could not have had such things as boilers, air conditioning and lifts without the assistance of GHD. He acknowledged quite readily the part that GHD had played in the development of the State buildings in the late fifties and early sixties. The mechanical and electrical practice of GHD in Tasmania has provided valuable support to the firm’s civil projects, such as water and sewage treatment plants, in addition to its commissions from private industry.

The strong basis of total service implemented for GHD in Tasmania after World War II by Bernard Callinan has continued to bear fruit in the company’s reputation for professionalism coupled with ethical principles.
Both of Hobart’s major hotels were engineered by GHD. The Sheraton Hobart Hotel was opened in 1987. The GHD Group took a leading role in organising this development and was appointed project manager.

The Wrest Point Hotel was built in the early 1970s. Its restaurant revolves once each hour — which I’m told is far slower than the roulette wheels in the casino downstairs.

A person driving now through Tasmania with its pleasant little towns and villages could find throughout the island the work of GHD. In no other State of Australia has proportionately so much engineering, surveying and planning work been carried out by one private engineering company.
This is the place for a Village

Not on the ocean, on a muted bay

Where the broad rays drift slowly over mud

And flathead loll on sand, a city blooms

Between the plains of water and of loam.

'Melbourne'
Chris Wallace-Crabbe
(1934 - )

This chapter should probably begin with the return of Bernard Callinan from World War II and his successful efforts to build and expand the Melbourne branch of GHD.

It is not possible to write about the Melbourne branch like that. The original work philosophies were laid down prior to World War II by the founders and some long-term projects which began in the mid-thirties continued into the 1980s.

The Melbourne office of GHD had been the jumping-off point for Gordon Gutteridge and his incredible drive in Tasmania and Victoria during the difficult years leading up to World War II.

Gutteridge was uncompromising in his attempts to protect his staff from the vagaries of business peaks and valleys. He employed the best staff he could find and was loath to lose any of them as a result of a temporary downturn in commissions. He successfully set out to lay the foundations of a widespread practice in local government areas, concentrating on water and sewerage schemes. He reasoned that there would always be the need for such work and he was assisted in his efforts by the method used in Victoria to finance such schemes. The projects were administered by constituted waterworks trusts and sewerage authorities, whose task it was to provide water and sewerage facilities to the geographical area under their jurisdiction.

These bodies obtained their funds for capital works from the State government and from private loans and were, in turn, given the authority to levy rates and fix charges to meet the annual costs of the works. The majority of the trusts and authorities did not employ engineers but engaged consultants to design and supervise the projects and, in many cases, supervise the all-important operation and maintenance of the works.

GHD, from the time of A. G. Gutteridge, has established a reputation for providing a total service for each commission. Its approach was particularly appreciated by local government councillors and members of the trusts and authorities, many of whom had had little experience in financial
matters. Indeed, the total financial budgeting experience of many of these representatives had been confined to the management and distribution of their own weekly wages.

Gutteridge would provide the preliminary design, an estimate of capital cost and estimated time for completion of the construction programme for a particular water or sewerage scheme, with simple explanations of the proposed works couched in layman's language. In addition, he would include an estimate of annual charges, plus a recommendation as to the necessary rate required to recoup these charges. His submissions on rates to be levied would include the estimated rates payable by a typical ratepayer within the area concerned.

It was always a complete submission, much appreciated by the representatives and limited administrative staff who felt that they were able to understand the technical and monetary details of the project.

Gutteridge's dealings with shires, municipalities, waterworks trusts and sewerage authorities did more than simply win commissions. They won for him and for GHD the respect and trust of these bodies and for many it began a relationship with GHD that continues to this day.

The immediate postwar years were a period of great demand for public works caused by deferment during the war years and lack of funds in the prior depression period. It was accentuated by immigrants and returning servicemen establishing many new households and a rise in expectations. However, the great problem was lack of human and material resources to meet other construction demands for housing, manufacturing plant, institutional buildings and transport facilities. The government imposed controls by various means including direct allocation of materials by permits, limiting size of houses and withholding statutory approvals and funding for State and local government projects.

The result was that although there was a great demand for GHD's services for public works engineering, survey and what is now called project management, there were many delays before funds or resources were available for construction. In many cases construction had to be by 'day labour' because of lack of contractors, unreliability of material delivery and extreme shortage of skilled labour. This meant that GHD staff searched for the most basic materials, continually changed design to suit whatever was available and acted as foremen for itinerant labour and construction managers for simplistic contractors.

The councillors, usually down-to-earth men and women (mostly men in those days), understood the situation and worked hand-in-glove with GHD staff to find equipment. They combed hardware suppliers and stores for even the simplest of equipment, none of which had been made in Australia or imported for six years. In some cases old pipes were actually reclaimed, cleaned and used again, such was the urgency of the job commissioned.

GHD engineers persuaded many merchants to begin importing materials, sometimes with quite unusual results. In one case, a merchant agreed to import asbestos pipes from Italy. They were landed at Melbourne for
transhipment to Tasmania. The cost of freight from Italy to Melbourne was far less than the freight cost from Melbourne to Tasmania. This was incongruous enough but, to add insult to injury, the pipes which had arrived at Melbourne intact arrived in Tasmania with forty per cent damaged beyond repair!

The same sort of problems confronted GHD in Queensland and New South Wales, and were overcome in similar ways.

It was not only equipment, but labour, which was scarce. The enormous expansion of secondary industry in Victoria, coupled with the demand for public works, gave labour a wide choice of jobs. Labouring on public works projects did not appeal to many young people and was regarded with some derision by the thousands of young soldiers demobbed from the fighting forces.

The consequent relationship and respect for each other's problems between GHD and local government was simply a cementing of the relationship which had begun with Gutteridge. This relationship, almost like a partnership itself, was not confined to a single council but to an impressive list of local government authorities like those of Warracknabeal, Nhill, Stawell, Mornington, the township of Dimboola — of film fame — and many others which are valued continuing clients after 50 years unbroken service.

An example of this rather special relationship between GHD and its client is the ongoing City of Hamilton sewerage scheme. The City of Hamilton, with a population of over 10,000 in 1985, is situated in south-western Victoria about 300 kilometres from Melbourne.

GHD has worked with the city fathers of this splendid area for more than fifty years. Gordon Gutteridge designed the city's original sewage collection system and treatment plant in the 1930s. The plant consisted of a primary sedimentation tank, four trickling filters, two humus tanks, anaerobic digester and sludge drying beds. The effluent was disposed of by irrigation. In 1958 GHD was commissioned to upgrade the plant to enable it to serve the increased population. At that time a new inlet structure and new primary and secondary tanks were installed.

In 1981 the Hamilton Sewerage Authority, concerned about increased loading on the plant and the need to meet stricter effluent limits, engaged GHD to investigate and report on augmentation of the treatment plant. The augmentation strategy proposed by GHD was accepted by the Authority and the several government authorities involved.

Stage I of the strategy involved construction of three polishing lagoons comprising a total area of five hectares, plus improvements to the grass filtration area. The Stage I works, with a value of $250,000 were constructed by local contractors, Hamilton Earth Movers, and were officially commissioned on 7 July 1982.

In a letter to GHD the Authority's engineer, Mr Kevin Safe, praised the co-operation between all parties during the project and expressed the Authority's satisfaction with the high standard of the newly constructed works, plus improvements to the grassed irrigation area.
GHD completed the design and commenced supervising the construction of Stage 2 works, comprising a low-energy, anaerobic, fully-mixed and heated digester and under-drain sludge drying beds. These works, estimated to cost $750,000, were completed in 1984. The project team for Stage 2 included John Murray, job manager, and Jonathan Crockett, project engineer, both from Melbourne office and Chris Lloyd from the Horsham office as the site engineer.

Another example of GHD’s extended work in a particular scheme is the Mornington Peninsula sewerage scheme. In the mid-1930s the councillors of the Shire of Mornington, a delightful recreational area on Port Phillip Bay, decided that sewerage facilities would enhance the value and attraction of the town area for its few thousand residents. In 1939 the Mornington Sewerage Authority was established to provide sewerage facilities for up to 6000 persons. The scheme was partly constructed when the works were stopped because of World War II.

The establishment of an Army Camp at Balcombe during World War II necessitated the construction of a pump station at Mt Martha, with a connecting rising main, to serve the camp. These works were not wasted — they later formed the headworks for the Mt Martha sewerage system. The disparate portions of the Mornington and Mt Martha schemes were connected and extended in the early postwar years by GHD with Ben Fink acting as project engineer. This was to become the initial element in the Mornington Peninsula scheme.

The rapid postwar growth of Melbourne during the 1950s pushed permanent residents into previous recreational suburbs and the Bay suburbs expanded rapidly, with new suburbs being formed to cope with the increased population.

The Bay was a difficult area for the installation of a sewerage system
but an even more difficult area to handle by the ancient night soil collection and by the use of septic systems. The very flat topography did not assist the septic systems and the very high watertable strictly limited their effectiveness.

In the early 1960s the need for a modern sewerage system was so pressing that the Councils of the City of Chelsea and the Shires of Frankston, Flinders, Cranbourne and Mornington separately commissioned GHD to prepare feasibility reports for the introduction of sewerage systems into their areas. Additional schemes have since been added to accommodate residents of Carrum Downs and Langwarrin. The then population of the proposed sewerage area was 99,000 and designs were prepared to accommodate 253,000 people. By 1983 these schemes provided sewerage facilities for 200,000 persons and the design population had increased to 350,000. It was fortunate that the various councils independently appointed GHD as engineers, surveyors and project managers as this led to an integrated strategy and common standards for the contiguous areas.

The Bayside schemes provide a story of resourcefulness. The difficulty of the area, from a sewerage point of view, necessitated a concentration on economies at every turn to keep the annual rates charged to the property holders at an acceptable level. One of the principal areas for reduction of capital costs, compatible with efficient and economical operation, was the reduction in the volume of both permanent water and stormwater infiltration into pipes of the collection system, not an easy task in an area with a high watertable. GHD engineers have been very successful in this field.

The Bayside suburbs are as delightful as they ever were but now more people enjoy living there. The sewerage schemes that include over 1200 kilometres of sewers, seventy pumping stations and three treatment plants drastically altered the lifestyle of the residents. The population is still

*Original Mornington Sewage Treatment Plant, circa 1940.*
increasing but so are the sewerage schemes. The sewerage authorities and GHD are still working together and as always during the last twenty-five years are a little ahead of their problems.

This large continuing scheme has involved many GHD people. Ben Fink negotiated the commissions and directed the initial planning, management, design and construction of the schemes with John Murray as project engineer, later joined by Frank McGuire and Colin White. Alan Longstaff took over from Ben Fink and has since continually directed the scheme. A critical element of the service has been the survey and drafting of the many plans covering the great areas to be sewered. This work has been directed since the beginning by Ivan Miller, with Phillip Meinhardt as photogrammetrist and Tom Maher as managing surveyor.

When Callinan returned from the Services and took over from Phil Scott as manager he was faced with the task of virtually rebuilding the practice in Victoria as well as in Tasmania.

He immediately decided to employ young graduates and in 1946 Geoff Sparks entered the office, which already numbered six people including Mrs Benedict, a trainee draftsman named Jeff Dall and a tracer, Miss Corrigan. Geoff Sparks retired in 1980 after thirty-five years of continuous service with the practice.

Jobs came in fairly quickly necessitating the employment in 1947 of an additional graduate, Alan Strom, for work in the Melbourne office, followed in 1948 by a young engineer, Ben Fink, recruited to replace Geoff Sparks who was transferred to New South Wales. John McCann was interviewed in Melbourne by Davey in 1947 almost at the same time as Strom. McCann was offered a job at GHD in Sydney provided he paid his own fare and removal expenses. He accepted the job at the wage that Davey offered him, nine pounds five shillings ($18.50) per week.

Callinan was a great believer in diversifying the scope of work which could be performed by GHD and he foresaw the future in urban planning. He returned to Melbourne University in the mid-1950s to study this subject as a part-time student and after three years topped the class with honours. This virtually added an additional discipline to the scope of GHD without the necessity of employing another engineer.

This extra degree also allowed Callinan to gain commissions, giving him contact with the town councillors and, from that base, like Gutteridge before him, he continued to build respect for GHD, leading to more and more commissions from local government.

Callinan was an extremely hard-working manager and expected similar efforts from his staff. When jobs were to be done there had to be, from his point of view, an almost total commitment until the project was complete.

Peter Manger who was appointed a director in 1978, recalled that when he joined the practice in 1961 as a young graduate straight from Melbourne University he was plunged, for a nine-months period, into the preliminary design of 1000 kilometres of sewers for feasibility reports for the Bayside sewerage scheme. There was no break in the type of work and, although the
staff generally kept normal hours, they had to travel and attend meetings outside of regular working hours. There was no pay for overtime; in fact, not a great deal of pay at all yet Manger remembered that all the staff, including Callinan, worked the same long hours as if each person were individually responsible for the project in its entirety. However, Callinan never liked to see staff jaded from overwork so his theme was that the staff should enjoy their work and realise their overall responsibilities yet at the same time ‘work to live, not live to work’.

An interesting project, and another first for GHD, was the designing of a prestressed concrete bridge at Portland, believed to have been the first such bridge in Victoria.

Portland in the postwar years was, after Melbourne and Geelong, the only other commercial port in Victoria. The government decided to expand the facilities to serve the Victorian Western District and the Portland Harbour Trust planned wharves, breakwater and onshore facilities. These included a harbourside access road and a creek diversion.

The firm was commissioned to design and supervise construction of a bridge over the creek diversion. Prestressed concrete as a form of construction had only recently been developed, first in France and then the United Kingdom, and young Australian engineers were reading about it and attending lectures on its design and application. When the Portland Bridge commission was received it provided a golden opportunity to try out the new structural system. The proposed bridge was to be quite small — a single span — and, in fact, the major technical problem was in the retaining wall system and the need to construct the greater portion below ground level. Nevertheless, alternative designs were prepared for both a prestressed superstructure and a reinforced concrete superstructure.

Ivan Baldwin, a contractor of some reputation in local government work in Victoria, worked from a suitcase of plans, with his total permanent staff of one very faithful foreman plasterer. Ivan used to travel to the routes of the ‘swagmen’, the prewar itinerants of the bush, enlist them for work and transport them to the job site! Strangely enough, Ivan managed to complete his projects, although understandably never on time, despite an enormous turnover of staff.

Alternative tenders were invited and the tender from Ivan Baldwin was eventually accepted for the first prestressed concrete bridge in Victoria.

It was a great matter of pride for all concerned, including the ‘Bush Contractor’ Ivan Baldwin, who had never previously heard of prestressed concrete, let alone used it, before he responded to an advertisement from his favourite consulting engineers.

Many years later, Baldwin was awarded contracts by the Queensland Main Roads Department to build in succession several bridges on the Gulf and Peninsula Developmental Roads in North Queensland, for which the Cairns office of GHD had prepared the designs and supervised the construction.

On completion, at Portland, GHD was asked to test the bridge to almost
double design capacity as the Harbour Trust wished to transport rock from a quarry for the breakwater. To test it Ben Fink obtained the co-operation of the CSIRO. They arrived with complex strain-measuring gear and wrapped the little bridge with a multitude of wires to transmit to the recorder the strain in the bridge as Euclids were driven over it loaded with rock, first slowly, one at a time, then quickly, one after the other, and then the empty trucks returning. The bridge passed with flying colours and many photographs were taken although it has been said by some senior staff that no one dared to stand under the bridge during its testing.

One commission worthy of note in Victoria was the advanced design of a factory for Rowntree, the chocolate makers. GHD has designed many excellent industrial projects and factories in Victoria and Tasmania but the Rowntree factory was one design which required a lot of thought. An unusual feature of this project was that GHD was appointed as the primary consultant, whilst the architect was a secondary consultant.

Chocolate manufacture requires heat, with excessively high temperatures in some areas, for such mundane jobs as roasting the cocoa beans. Cool areas are also required where finished chocolates may be stored without danger of melting. Both climate zones must be located in the one factory.

In addition, tastes change in the chocolate world from season to season (they don’t make Snowballs in summer!) and the competitive nature of the industry requires that new types of confectionery be introduced on a regular basis. New sweets and new varieties of old sweets may require radical changes in machine capacity and consequently floor space for new machines.

GHD decided to design an elevated machinery gallery, six metres wide, to run the entire length of the factory. On the elevated section the total air conditioning plant was located, off the factory floor, allowing for rearrangement of machine space without any dislocation of production and, of course, greatly increasing the floor space available for manufacture. In addition, the design incorporated the placement of ‘service’ areas to include all cables, pipes and extraneous machinery outside the production area.

The factory was an example of innovative designing which influenced the work of other design engineers on similar projects.

GHD has built up a reputation over the years, not only for engineering expertise but for strict observance of ethical standards and of integrity. This high reputation was recognised when GHD was called in after the West Gate Bridge tragedy and GHD can take more than a little pride in the completion of this bridge.

In July 1970 the collapse of the Milford Haven Bridge in Wales put out a warning that modifications to the design of the West Gate Bridge should be contemplated. Additional strengthening of the bridge was made as a result but, tragically, it was not enough. Less than three months later, on 15 October 1970 at 11.50 a.m., the 367 feet (128 metres) span of the West Gate Bridge, known as span 10-11, collapsed. Twenty-five men were killed immediately and a further ten died as a result of their injuries. It was the most tragic industrial accident in the history of Victoria. The whole State was stunned by the
magnitude of the disaster.

The immediate cause of the collapse was the subject of a Royal Commission. The Commission found that there were several causes, including the primary one that, 'The designers of the bridge failed altogether to give a proper check to the safety of the erection proposals put forward by the original contractors, World Services and Construction Pty Ltd.'

The Royal Commissioners, after tabling their findings, added that, 'There are a great many features which require further investigation. It is therefore our considered view that the whole design of the steel spans should be thoroughly re-examined by an independent consultant in the need to assure the future safety of the structure'.

The recommendation by the Commission was not one which met with great approval by many consulting engineers. There was much more to the matter than engineering aspects for there had followed an almost total lack of confidence by the public that the bridge would ever be built at all in its proposed form. The trade union movement also had no confidence in the capacity of engineers to design such a bridge and one could not blame them for their attitude.

As if this were not enough, there arose political overtones of quite bitter intensity and it became clear that the public would not be happy unless the bridge was redesigned by Australian engineers.

There were many problems for the West Gate Bridge Authority, perhaps the biggest being that the Authority had no engineering capacity in itself. It employed only a small engineering staff and was not equipped to take full responsibility for the completion of the bridge.

Outside Australia the expertise available presented difficulties. In North America, for example, there was very little experience at that time in the designing of cable-stayed bridges. The Germans were capable of designing such bridges, but the most suitable firms did not have engineering organisations which could fit into the systems used in Australia.

Finally it became apparent that there would be few groups of consulting engineers in Australia who, in the political climate of that time, would be prepared to accept sole responsibility for the redesign and ultimate completion of the bridge.

In the absence of Sir Bernard Callinan overseas, Ben Fink, a driving force in urging Australia's acceptance of consulting engineers as a specialist section of the profession, persuaded the Bridge Authority to establish its own Directorate of Engineering and to subsequently request consulting firms to second, or make available to the Directorate, engineers with specialist qualifications for such a task. It was a bold move but, as a result, the proposed Australian content provided a basis for confidence by the public at large, the trade union movement and the whole gamut of the engineering profession.

GHD started the ball rolling by seconding Hans Wolfram to the Authority. Wolfram's role in GHD was to concentrate on structural engineering, particularly in building, bridging and gas pipeline projects.

Ben Fink suggested to the Authority that a search be made, worldwide,
for a person of reputation to head the Directorate. An eminent Scottish consultant engineer was appointed to the position but, oddly, the relationship did not work out as planned and after three months Hans Wolfram replaced the Scot as head of the Directorate. It was a daunting task, challenging and demanding, but the new Directorate was able to complete a ‘Report on Review of Tasks and Organisation Required for the Completion of West Gate Bridge, Melbourne’ by July 1971.

GHD continued to assist in the mammoth project. It provided initial office space for the Directorate in its own building, made available its computer services, library and incidental facilities, plus its specialised survey services for survey matching of steel boxes during erection, and the design and supervision of the bridge fire-fighting systems.

In the matter of staff, GHD played a significant role in addition to the secondment of Hans Wolfram. Robert Lloyd, Andrew Jackson and Norman Nancarrow, all experts in their fields, were also seconded to meet the particular needs of the Directorate.

The Chairman of the Board of Directors of the Authority, during and after construction, was Oscar G. Meyer OBE, and the Vice Chairman was GHD’s Sir Bernard Callinan CBE, MC.

The West Gate Bridge was opened on 15 November 1978 by the Premier of Victoria, the Hon. R. J. Hamer ED, MP.

Another significant project of a different kind was that of controlling wastewater, potentially dangerous to the environment, from a power station.

In 1977 GHD was commissioned by the Latrobe Valley Water and Sewerage Board to carry out investigations for, and the detailed design and supervised construction of, a submarine ocean outfall. It was planned for the pipeline to discharge saline wastewater from the Loy Yang Power Station into Bass Strait.

The saline water was a by-product of power generation in the Latrobe Valley. Due to its salinity and the presence of selenium, a heavy metal, this wastewater could not be discharged into the adjacent Latrobe River and, consequently, had to be pumped 52 kilometres through a pipeline system to the sea.

The pipeline in the sea was to stretch 500 metres from the shore. There were many problems, not the least being the corrosive nature of the wastewater. To combat this, the pipes were internally lined with a resistant material and protected on the outside from the equally corrosive effect of seawater.

GHD recruited other consultants for specialist services, but designed and supervised the total project which was completed on time in November 1981. Many difficulties were encountered, including inclement weather and the high test pressures required to be met for underwater flange jointing.

The client’s requirements included the all-important stipulation that there be no effect on the existing environment due to the deleterious substances in the effluent being discharged, and that the structural integrity of the pipeline in the continuously changing seabed be maintained.
The pipeline was laid seven metres below the seabed and was designed to last for fifty years. Many seaboard dwellers on the east coast of Australia, where it is not unusual to discharge sewage effluent directly into the ocean, would look with some envy at the system of discharging the wastewater from Loy Yang. GHD project manager was John Ryan, assisted during design by Ross Smith and during construction by Mike Rodd. This project brought together GHD and CHRM Hill of the USA, who provided specialist assistance, and this has led to a continuing friendship and technology exchange for water and wastewater systems with this world-reputed firm.

A completely different task to that of controlling wastewater has been the exciting introduction of natural gas as a source of energy in Australia. Natural gas technology is relatively new to Australia but GHD can claim that it has already built up the necessary expert knowledge through several assignments completed successfully for the Victorian Pipelines Commission and other clients. One of these was a feasibility study, route selection and assessment of engineering, economic and environmental factors of a natural gas transmission system from Sale, Victoria, to Sydney, New South Wales. Another of these projects completed for the Victorian Pipelines Commission was the surveying, design, supervision of construction and project management of a high pressure natural gas pipeline from Melbourne to Geelong.

GHD is a member of the American Gas Association and the Institution of Gas Engineers, London, and is a sustaining member of both the Australian Welding Institute and the Australian Welding Research Association.

The old line that ‘all that glistens is not gold’ could apply to the town of Dunnolly near Bendigo, once the scene of a gold rush. These days, gold in the form of wheat and barley is stored at one of the major sub-terminals operated there by the Grain Elevators Board of Victoria.

In 1981 GHD and Planner West were jointly engaged to modernise these facilities. The massive old timber structure had deteriorated and more modern and efficient facilities were needed. The team produced solutions which allowed the many different types of grain to be segregated, thus producing more efficient operation of incoming road transport and rail transport to the ports of Geelong and Portland.

The Board was pleased with the concepts and had similar work done at another sub-terminal near Horsham.

Fires and their destructive effect have always been a part of Australia but they are one type of phenomenon which never becomes so commonplace that we can shrug it off. Australians are generally devastated by the tragic consequences of fire and aid is always forthcoming from even the most unexpected sources.

I recall some years ago watching a young couple being interviewed in front of the ruins of their cottage in a bush suburb not far from where I live. They were dirty with ash and the three children were clinging to their parents; they had lost everything in the fire and, as is often the case, had not taken out fire insurance. Asked what they intended to do, the young mother said
that she could bear the loss of furniture and household items but the loss of the family photographs with all their memories was almost too much. I had never thought of such a consequence of a fire, of the tragedy of losing such precious keepsakes, but I remembered this incident when I learned of GHD’s involvement in the control of fires and its own loss from fires.

In Victoria, as in other States, GHD has engineered and managed the construction and operation of many town water supply systems. The great majority are in the country and many are in forest and other fire-prone areas.

A reliable water supply scheme is the most important facility for control of fires and this was exemplified during Ash Wednesday (13 February 1983) when a great part of the Dandenong Ranges was on fire, spreading towards the hill townships of Gembrook, Emerald and Cockatoo.

GHD had originally planned the water supply schemes and continuously serviced these schemes so it happened that Roger Byrne was attending an Emerald Water Board meeting that day when confronted by the fires. Fortunately, the scheme was served by diesel standby pumping systems which operated throughout the holocaust, supplying over three days one hundred and thirty water tankers drawing from various points in the district system. Roger made use of the unfailing telemetry system also operating on a standby generator to keep contact with the various system centres and did not return home until the following Saturday, well satisfied with one of the few water supply systems that had operated on occasions at 2.5 times its design peak, in bushfire areas throughout the State.

On 11 February 1982 GHD’s Melbourne offices at 380 Lonsdale Street were totally destroyed by fire. Not one single book from the technical library, one of the most comprehensive of its kind in Australia, was saved. The collection of photographs of work-sites, projects and of people on the job, were all destroyed, plus personnel records and personal files going back to Gutteridge’s day.

Almost all plans and drawings were destroyed, a miniscule proportion being saved plus a few files, but these were not only charred but were extensively damaged by water. Included in the drawings destroyed were some which had been completed the night before the fire. All facilities were destroyed including furniture and computers together with the work in hand of more than one hundred people.

What does one do in such circumstances? There were scores of projects in operation. The office was the workplace of over one hundred persons and the headquarters for a chain of GHD offices in Victoria, as well as serving Western Australia and closely liaising with other GHD offices throughout the nation. Len Wilke described the problems resulting from the fire.

Two days before the fire began, renovations had started on an old two-storey structure in Franklin Street purchased from Ansett a month earlier by the GHD Superannuation Fund, as an investment. The building was a solid structure but was totally inadequate for GHD’s operations so it had been planned to clear it out, upgrade the services and amenities and lease the building as office space until GHD was ready to use it in the future. No
date had been set for its occupancy by GHD.

The fire changed everything. Furniture was rented and delivered to the Franklin Street building the day after the fire and most of the staff reported for work at their new venue. The situation was almost a nightmare. Everyone was trying to keep in touch with interstate offices and with their own projects via the builder’s telephone. The builder and his workmen were removing partitions and literally knocking down walls around staff trying to establish some sort of order, while other GHD personnel were ordering and expediting the myriad of things necessary for a working office.

Over the next few days some relief from the chaos was gained with the installation of temporary telephone lines. The staff was arranged into working groups and the massive job began of recovering information on projects from clients and interstate offices and of salvaging remnants from the fire.

A large area of the ground floor was used to dump charred remnants of plans and water-damaged reports. The smell of burnt paper lingered in the building for months as plans, files and notes were systematically scanned for recoverable information, all of which was photocopied and microfilmed.

The decision to renovate 97 Franklin Street as the new GHD office began with the fire — there was nowhere else to go. GHD decided to act as project manager and appointed the builder, Dennis Brooke Constructions, as construction manager and W. E. Bassett and Partners as the electrical and
mechanical engineers. Begg, Barrack and Douglass, architects, were engaged to plan the layout and the interior design for the building and its facade, thus freeing GHD staff to service its clients and to reconstruct the records.

To virtually rebuild an old building to house and service a different industry from that of the former tenants is a major job. To do the job whilst people are carrying on business within the building becomes almost impossible, not only for the various consultants and builders but for the staff trying to function efficiently in quarters which, of necessity, are being shifted from one part of the building to another as each stage is finished.

Three weeks later, with the fire fresh in everyone’s mind and with no conclusive explanation as to its origin, thought to have been in the adjoining offices, a plumber working on the roof found a fire-bomb on the roof of adjoining premises. The plumber conscientiously picked up the device and carried it down into the office entrance, enquiring what he should do with it! The police were called and evacuated the building and blocked off Franklin Street before determining that there was no detonator fitted to the bomb. The Melbourne staff wondered whether somebody bore them malice, but some weeks later another bomb was found in a shop in the next street. The miscreants had evidently been on their way over the roof-tops when disturbed. They were in due course located, arrested and charged with the offences.

The offices for GHD were completed by December 1982 but the renovations for the rest of the building were not completed until May 1983. One of the many problems was obtaining the necessary approvals from the local authorities to proceed with the alterations as planned. The original building had been erected in the 1930s and subsequent changes to building regulations were the root of the trouble.
Despite all the losses, frustration, lack of facilities and data etc., all commissions current at the time of the fire were completed with virtually no delay and no loss of quality.

The Victorian practice had been resurrected in the post-World War II days by Bernard Callinan with a staff of five or six in a 50 square metre office at 472 Bourke Street, Melbourne, serving mainly public works reconstruction and expansion. In the mid 1950s when office space was at a premium, a single storey terrace house was purchased and refurbished in Grey Street, East Melbourne. During this period of great demand for housing, urban land development became the responsibility of the subdivider, thus adding a large private practice engineering element to a process which previously only occupied the surveyor. GHD became involved, with Ivan Miller acting as project manager and Mervyn Smith as surveyor. Shortly afterwards manufacturing industry started to stir, and GHD initially served as consultants on hydraulic services on what was then the largest, most modern food processing plant in Australia for H. J. Heinz. About that time GHD Victoria further expanded to begin its mechanical and electrical practice. This small practice was purchased as a goodwill gesture by G. I. Davey from the widow of his friend S. R. Bell who had recently passed away.

By 1960 the staff numbered about twenty and the Grey Street office was bursting at the seams, despite the tin garage that was illegally acting as an office for the surveyors.

A move was then made to spacious offices at the western end of Collins Street on the top floor of an old bluestone wool stores — since demolished.

At that stage Bernard Callinan's staff included, amongst others, Ben Fink as office manager, Ivan Miller in charge of survey and land development, Robert Lloyd, design engineer, the late Bruce Robson in charge of mechanical and electrical engineering, Mrs Benedict and Ann Moore, the latter continuing to serve as secretary to the directors in the Melbourne office. Alan Longstaff was resident engineer on the Stawell sewerage scheme, the first large postwar construction project, as well as other Western District commissions. Shortly afterwards he moved to establish and manage for some time the small Darwin office.

The early sixties was a period of great activity and expansion. Manufacturing industries were being established on green fields, land developed for housing, funds became available for public works and resources were freed for commercial and institutional building. GHD participated in all these and its multi-disciplinary practice was strongly established at that time.

By 1966 the Collins Street space of about 500 square metres was too small and for the first time ever they moved the fifty or so staff into brand new office space of about 1000 square metres at 380 Lonsdale Street and took a risk on the high rent.
Until 1965 Bernard Callinan was the only partner in Victoria and Tasmania, when he was joined by Ben Fink and Alan Strom to share the responsibility of the expanded practices.

The Victorian practice continued to grow during the latter sixties and the need grew for additional expert direction, firstly for structural and later for water management.

As a consequence, Hans Wolfram left the Department of Construction where he directed structural engineering and joined the practice, to later become a director.

During the late sixties some larger hydraulic projects became available from the State government and Alan Strom transferred from his position as manager of the Tasmanian practice to provide his expertise in dam and water treatment engineering in Victoria. His very successful practice and rise in eminence in that field in Victoria began with Bungal Dam, which received an Engineering Excellence Award from the Association of Consulting Engineers Australia. This project also began John Phillips’ fine career in dams as resident engineer.

Environmental issues became of political and public concern with the advent of the seventies and GHD became involved with one of the first large environmental studies when it was commissioned by the State Rivers and Water Supply Commission for the state-of-the-art study on salinity in the Murray Valley. This renowned study was directed by Bernard Callinan, with Peter Hallows acting as study coordinator.

GHD has since been continually involved in environmental studies as a consequence of its water management and planning capability and experience in multidiscipline study management.

During the late sixties and early seventies the Victorian practice expanded further as, in addition to the ever increasing State and local government work, the office was commissioned for gas pipeline work, land development continued and the initial overseas projects by GHD in South Korea, Malaysia and Bougainville were staffed mainly with Victorian personnel.

The photogrammetry section was established in Melbourne under Jim Trench’s sponsorship, Ivan Miller’s direction and Phillip Meinhardt’s expertise following his study at the University of Delft in Holland.

Don Skinner was transferred in 1970 from the Hobart office to manage the mechanical and electrical section, which was serving the many multi-disciplinary projects as well as providing external sub-consulting services for commercial, industrial and institutional buildings.

In the early seventies it became evident that further specialisation was required to keep abreast with changing technology and an ever widening scope of practice. It was necessary to involve chemical engineers in water and wastewater treatment which was basically founded on chemical process. Ian Sandford was recruited as the first chemical engineer and when he left he was succeeded by Jonathan Crockett who, with the support of Alan Strom, has built up a chemical engineering team to advise the national practice on chemical process technology.
Tom Fricke was transferred from Tasmania as a young civil engineer in the late sixties and widened his experience in hydraulic engineering leading to the establishment of a highly expert and eminent group in hydrology.

Following his stay in Darwin Alan Longstaff returned to Melbourne in the mid sixties, where he later took over from Ben Fink a major portion of the Mornington Peninsula commission and other Water Board services. He has ensured GHD's eminence in that field by directing an ever widening range of services to the water industry and acting as director in charge of sewerage systems expertise and the marketing of these services overseas.

By the mid seventies there had been a complete change in the economic development of Australia which particularly affected Victoria. All manufacturing industry development had virtually stopped because of our high dollar value and government policy on tariffs and unlike other States Victoria did not gain much from the energy boom of the early eighties. Therefore until the present time an element of the practice had vanished, but in recent years the Victorian practice has been stable and has maintained its position.

In 1983 Peter Manger, who started his career with GHD in the Melbourne office on graduation, returned as manager-elect of the Victorian practice and chairman-elect of the Victorian/Tasmanian region. He thus became in 1985 the third manager of the Victorian practice after forty years of successive management by Bernard Callinan and Ben Fink.

One aspect of the place of GHD in the consulting engineering profession in Victoria has not changed. Gutteridge and Davey were prominent in supporting an ethical engineering profession and their lead has been continued over the years by GHD staff.

Sir Bernard Callinan was always a prominent member and councillor of the Institution of Engineers in Victoria, culminating in a term as president in 1971. In that year Callinan received a CBE for his services to engineering and, in the following year, was presented with the Peter Nicol Russell Memorial Medal. In 1977 Sir Bernard received a Knighthood, again for his services to the profession.

In 1978 Sir Bernard Callinan retired. He was at that time Chairman and Managing Director of GHD. From the virtually non-existent Victorian practice of 1946, Callinan had built a vibrant, enthusiastic office with an enviable reputation for efficiency and integrity. During those years he had also had the responsibility for both the Tasmanian and Western Australian operations. The accumulation of commissions from dams to factories, from wharves to industrial projects, and to mammoth water and sewerage projects, has been and is quite formidable. Bungo Dam, for example, earned an Award for Merit and is described in another part of this volume, as is the project in Bougainville. Both projects were Melbourne-based.

Ben Fink was appointed as Managing Director following the retirement of Sir Bernard. He has also made an impressive contribution to the engineering profession.

One of Ben's major aims in the professional family of engineers, in which
aim he had considerable success, was to place the practice of consulting engineering on a very special plateau. The consulting segment of the engineering profession is quite small and the number employed in independent practice is few in comparison to the total number of professional engineers.

Ben worked to ensure that consulting engineering was a distinct and respected section of the profession, that its standards were the highest and that its ethics were without blemish. He believed that the integrity and ethics of consulting engineers should be a byword in the field of engineering and so it has come to be. To achieve this, and to raise the standard of private practice, he participated in continuing reviews of the professional Code of Ethics, Terms of Engagement and Minimum Fee Scales.

He was Chairman of the Civil and Municipal Branch, Victorian Division, The Institution of Engineers, Australia in 1971; Chairman of the Victorian Committee of Management of the Institution of Civil Engineers, 1971-72; and Honorary Secretary, 1966-69. He was President of the Association of Consulting Engineers Australia 1978-80 following very active participation in the Association from 1963. In 1982 Ben Fink was awarded the Consulting Engineers Advancement Society Medal for ‘Outstanding contribution to Australian engineering’. The awards to both Callinan and Fink are proof that GHD is mindful of its responsibilities to the engineering profession and is prepared to work to that end.

Finally, the projects investigated, designed or supervised by GHD in the State of Victoria cover the whole strata of engineering services from recreational facilities and urban planning to bridges and hydrological services and a galaxy of others. Four projects engineered or studied in the natural gas field in the years 1969-71 were estimated to cost in excess of $90 million, whilst in the fifteen years prior to 1977, GHD in Victoria investigated, designed or constructed sixty-two sewerage schemes!

The relationship between GHD and its clients is of prime importance to the company. For every project a GHD director is nominated as project director, thus establishing a top level contact to which the client’s management can look for overall, successful, project completion.

During this first sixty years of the practice, water supply (including dams and treatment plants) and complete sewerage schemes were the backbone of GHD in Victoria. The enormous Mornington Peninsula sewerage scheme began as a prewar project and continued into the 1980s, with GHD still providing all the necessary engineering and project management services. There are literally dozens of towns in Victoria which have been provided with these essential services by GHD and in many of them important innovations have been introduced.

The Victorian practice continues to grow but is not confined to projects in that State. With the introduction of specialist sections to deal with different aspects of engineering throughout Australia, the Melbourne office plays a vital role in the organisation.
In Sydney Town

The Governor loves to go mapping — round and round

The inlets of the Harbour in his pinnace.
He fingers a tree-fern, sniffs the ground
And hymns it with a unison of feet —
We march to church and executions. Not one,
Even Banks, could match the flora of our fleet.

'Sydney Cove, 1788'
Peter Porter (1929 -

The Sydney office of GHD occupies a rejuvenated Berlei House in Regent Street, Sydney, adjacent to Sydney Central Railway Station and conveniently placed to serve all metropolitan clients.

The building was previously used to produce the famous Berlei undergarments and, having been built to accommodate light industrial work, presented a challenge in its transformation to a modern office complex. The transformed building was officially opened on 29 March 1985 as the headquarters for the NSW Region and the Corporate Financial Group of the practice. It is a practice with widely distributed centres of control. After becoming Chairman of Directors in 1978, Bob Rivett worked from the Brisbane office and the Managing Director, Ben Fink, from the Melbourne office. When appointed Company Secretary in 1981, Trevor Saunders (who assured me that he could work from any office without dislocation to his task) worked from Sydney.

GHD in NSW, by reason of its growth and through mergers with other practices, has continually outgrown its offices; at times it has been scattered around the city and suburbs. In 1955, for example, a separate office was set up at St. Marys Munition Works and from there a team of engineers worked on the designs of buildings and civil works associated with the munitions factory; that particular team was headed by Albert Streber.

GHD offices have not always been as modern as they are today and again this has been as a result of the urgency at times of obtaining any office space at all.

In the office set up after World War II at 60 Hunter Street, Sydney, the drawing office was definitely of the 'old school'. Long benches with rows of drawing boards set up end to end; the drawing boards were of the old T-square type on angle rests. The majority of the staff were graduate engineers who were required to produce their designs and also prepare associated drawings. There were no draftsmen, and two female tracers traced off the plans in ink on linen. The drawing office supervisor was a civil engineer by the name of Hans Stern, part of whose job was to regularly circulate around the corridors
checking the engineers’ work. Mr Stern wore a grey dust coat and the drawing office took on the appearance of a classroom, particularly considering the majority of the staff were under the age of 30 years.

An interesting little vignette of the Hunter Street staff is worthy of recall. One of the civil engineers, Jack Soulby by name, after much agonising decided to leave engineering and join the priesthood, thus predating Geoffrey Davey’s similar decision many years in the future. Jack presented an early Dudley Parker painting to GHD as a token of his esteem for the firm.

The return of the staff from St. Marys in the late 1950s caused a problem in space and a second office was set up in Castlereagh Street. The two offices made it difficult to expedite the work of the mechanical and electrical sections, particularly as engineers from both offices were often working simultaneously on the one project. An additional office was acquired in O’Connell Street to allow the mechanical and electrical sections to be housed under the one roof, but the practice was still hampered in working from two offices, Hunter Street and O’Connell Street.

In the early 1960s the practice consolidated into an elderly building in Young Street, City, near Circular Quay, but this move was of brief duration. The building was due for demolition in 1968, necessitating a further move, this time to Clarence Street, City.

In 1977 it was decided that a move out of the city should be made and after looking at a number of locations GHD purchased a three-storey building at Young Street, Neutral Bay, for its Sydney headquarters. Two upper floors and part of the ground floor were occupied, involving a total of 2200 square metres; the rest of the ground floor was let.

The Sydney office is a multifaceted organisation. It is the headquarters of the New South Wales Regional Board, chaired by Roger Smith, which is responsible for the operations of the practice in New South Wales and the Australian Capital Territory. Timothy Smyth is responsible for operations in Malaysia; Don Dwyer is the director responsible for the Corporate Business Development Group, managed by Peter Hamilton — this group undertakes marketing and business development of the practice throughout Australia; Ted West and Neil Wyles have the technical responsibility for the whole firm in the fields of mechanical and electrical services respectively; Ken Conway looks after special projects such as the Sydney Monorail and the East Hills-Campbelltown railway; Ron Van Es is in charge of the roads section; Brian Mahony’s specialities are plant engineering and maintenance management; and John Planner heads the mechanical, electrical and plant practice of the firm on a national basis.

The Sydney office includes a major reference library holding approximately 10 000 items, plus the regular receipt of 200 journals. In 1980 Joan Dickinson, a Bachelor of Arts and an Associate of the Library Association of Australia, was put in charge of this collection.

All GHD major offices have excellent libraries but some offices specialise in certain areas. The Melbourne office library has a wide range of publications on water and wastewater technology, environmental pollution and others.
Brisbane has a collection on geotechnology and the Perth office has a notable collection on tailings disposal.

The aim of the company is to be in a position to research any facet of any engineering area and to do it quickly. It would be difficult for any one organisation to hold all relevant publications so GHD belongs to Access, a group of fifty-four architectural, construction and civil engineering libraries in Sydney. All members of Access are willing to share information they hold in their own libraries.

The structure of the administration initiated from the Sydney office is not difficult to outline but a summary of the projects initiated from there certainly is; they cover almost every conceivable type of engineering.

Some of the projects completed in the last fifty years have had almost Wild West overtones. John McCann was at one time the resident engineer at the Coombing Creek Dam on the Central Tablelands. McCann had taken over from Geoff Sparks and the job was not proceeding according to schedule. The contractor had struck difficulties in the preparation of the foundations of the dam and, in addition, was plagued by industrial troubles. Overall, though, the contractor did not appear to be as worried as McCann was over the delay.

Davey went up on an inspection at the request of McCann, saw the problem, sacked the contractor on the spot and took over the total supervision. By the end of the day McCann, who was twenty-five years old, was in charge of the project being built by day labour.

GHD has gained an enviable reputation in dealing with all aspects of water in all States. The practice has designed and supervised the massive Southern Riverina District scheme based in Wagga Wagga, the Northern Riverina water supply scheme — a large project — and a scheme covering water supply on the south coast of New South Wales in the Nowra, Moruya and Bateman’s Bay districts.

In sewerage works alone GHD has reported on, designed and, in most cases, supervised construction of sewerage systems for more than two hundred towns servicing about 800 000 people. That’s a lot of towns for one practice — it included 4000 kilometres of sewer mains.

It has been suggested, and understandably so, that for some years the main area of engineering performed by GHD was in the water and sewerage field.

This has been true in essence but there have always been many projects (more so in recent years) in other fields. Selecting one year at random, 1950, the variety of work, much of it major, in operation at that time in New South Wales included:

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<td>Electrical Services</td>
<td>9</td>
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<td>12</td>
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<td>Survey Work</td>
<td>16</td>
</tr>
</tbody>
</table>
Penrith Municipal Council is one example where a very close relationship between the council and GHD has been maintained. GHD began working with the councillors of Penrith in the 1940s. Project after project has been broached, discussed, designed and completed with a feeling of accomplishment by both parties.

One project which GHD carried out for the Penrith Council had a happy aftermath not only for the residents and visitors to the district but for GHD too.

A steady increase in the population of the Penrith area had led to the city’s wastewater plant becoming overloaded. In effect it was no longer capable of producing effluent of the clarity required by the authorities for discharge into the beautiful Nepean River. A revolutionary plant design reduced the nutrient loads in the effluent, so increasing the purity of the water being discharged into the river. The consequence has been an improvement in the river waters for recreational purposes.

For this GHD, at the presentation of the 1985 Engineering Awards, received a Merit Award for a ‘Nutrient Removing Wastewater Plant’, from the Association of Consulting Engineers Australia.

The provision of electricity for the people has always been a strong field for GHD. It does seem strange to realise that electricity was not even available to vast areas of rural New South Wales in the 1950s and even into the 1960s.

Beginning in 1948, under the direction of Albert Streber, before he became a director of GHD, transmission lines, with all their attendant high voltage switching, distribution substations and high and low voltage tower reticulation systems, were erected in northern New South Wales. The slender towers and the long lines carrying the precious energy snaked their way across 5000 kilometres, changing the lives of people in six shires.

GHD provided a total package to shires. Financing procedures, operational management and tariff details had to be studied and presented to the councillors who constituted the local authority. In most instances, GHD’s engineers administered the contracts which were let for the supply of materials and the construction of transmission lines, substations and reticulation.
Streber, a very gentle man, recalled with pleasure his meetings with farmers and homesteaders far from the towns. Many invited him to sit with them to share their delight when the power was switched on.

GHD has never considered sending its engineers underground but, as far as the development of mining, transportation of coal and mining projects are concerned, it has given and continues to provide a total service for this important type of development.

It has designed rail balloon loops and rail spurs, coal unloaders and conveyer systems; examined options for the haulage of coal to the seaboard, and over mine subsidence areas, and undertaken environmental studies. GHD is involved in the mining industry in all States of Australia.

One of the largest commissions given to GHD was as project manager for the development of the Mt Arthur North Open Cut Mine in the Hunter Valley of New South Wales, for the mining of black coal. The size of the commission, which was under the direction of Peter Manger, dwarfed all previous projects of GHD in the mining area. The plans called for the mining of eleven million tonnes of coal per year. When developed this mine will create considerable employment in the area and exports will have considerable effect on the finances of the New South Wales government. The reduction in coal prices in the early 1980s, and the local reduction in power and consequent coal usage, persuaded the consortium to call a temporary halt to the project after much of the preliminary work had been completed. It was estimated that the total capital cost would be from $350 to $400 million. That is a big project!

Sometimes consulting engineers are forced to work at a higher pace than either they or other people care to do but, in cases of urgency, they rise to the occasion. The Vales Point project was a matter of extreme urgency. GHD was asked to design and act as project manager for supplying facilities to augment the coal supply at the Vales Point Power Station on the central coast of New South Wales. The authorities were worried by the fact that they normally held only a month's, or perhaps two months', supply of coal for what was a very important power station in the electricity grid system of the State.

Within twelve months of acquiring the commission the coal was being received at the storage facilities at the power station. The work had involved an environmental study, a rail loop and a massive conveyor belt. It had all been done — the studies, engineering designs, calling of tenders and appointing of contractors — but even the contractors, on accepting their contracts, were privately sceptical that the job would be finished on time. They were wrong. Project director for the job was Peter Manger and the job manager was Ken Conway, while Denis Pout was responsible for electrical engineering and materials handling.

Structural engineering changed dramatically in Australia after World War II. From the early 1950s buildings became more and more innovative and structural engineering became a speciality or, as it is known, a separate discipline in the engineering field. The specialisation was necessary and was originally fostered by Professor John Roderick of Sydney University, who
taught new concepts of structural analysis for Sydney-trained engineers.

Roger Smith saw the new field developing and resigned from GHD in 1953 to work in structural engineering for two years in the United Kingdom. He rejoined GHD in 1955 and was appointed manager of the New South Wales region in 1983.

GHD designed Citra House, the site of the American National Club in Macquarie Street, Sydney. There were some difficulties, one of them being the necessity for the Club to remain in operation during the rebuilding in order to keep its liquor licence.

The Club owned one terrace adjoining and was able to purchase the terrace on the other side of them. They were unable to persuade the owners of a third terrace building to sell so that it remains today, as it has been since 1969, the home of the Royal Australian Historical Society, one of Macquarie Street’s last remaining examples of mid-Victorian architecture — History House.

The terraces on either side of the Club were demolished and excavations carried down five floors below street level for the foundations of Citra House. When the building was five floors above street level (still with the American National Club standing on its own), the three top floors were completed and connected with the lifts and stairs. The Club then simply moved upstairs and
continued in business whilst the engineers demolished the old Club premises, excavated five floors and virtually filled in the middle.

I liked that story but was equally fascinated to learn that the Angus and Coote building in Sydney, sited over the Eastern Suburbs Railway and so subject to continuous vibration, was designed by GHD to sit on rubber pads as shock absorbers!

Engineering services and structural work have been carried out all over Australia. These range from the design for the Manly Marine World in New South Wales to the checking of building structure designs of the Collins Plaza Centre and Nauru House, both in Melbourne and both 52 storeys high. John Fisher of the Sydney office made an independent engineering check of these latter two buildings for the Melbourne City Council.

GHD was involved in the 1950s with the Atomic Energy Commission at Lucas Heights; New South Wales, with the design of the High Activity Handling Cells using high density concrete. Don George, the Australian Atomic Energy Commission project manager for that job, later became the Vice-Chancellor of Newcastle University.

One unusual job was the structural design of the Catholic Church at Asquith, a suburb of Sydney. It wasn’t so much the design which was unusual, it was the use by the architect of the old stones which had floored the now
demolished sheep and cattle saleyards at Flemington, Sydney. The Parish Fathers had bought the stones as a job lot for a song. There were enough for three or four churches and parish labour was used to lay them. The result — old stones in a green grass surround — is appropriate and refreshing.

Perhaps of all the regional offices of GHD Sydney office is the one that was most affected by the impact of mergers which took place between 1979 and 1982. During this period over one hundred new personnel joined the practice in the NSW Region and a great deal of time and effort was spent in bringing the practices of D.J. Dwyer & Associates and Planner West into the GHD fold.

The merging of these practices was a significant achievement for all who participated and the results of their efforts can be seen today on a tour through the Sydney office, where practically every sector of the GHD Group of Companies and areas of technical discipline are represented.

The merging of the Dwyer and Planner West practices with GHD was timely in that it enabled the GHD Group to respond to the coal and power boom of the early 1980s. Major projects were undertaken in most coalmining areas that encircled Wollongong, Sydney and Newcastle, and the Hunter Region became a very well-known area for the GHD team.

The small Newcastle office of D.J. Dwyer & Associates was enlarged and staffed to meet the new client requirements. Tom Pinzone was appointed as the manager of this new GHD office in 1980 and very quickly became part of the Newcastle scene. The GHD Office under Tom’s guidance has expanded and with a subsidiary office at Wyong it now provides consulting services for that part of the State north of the Hawkesbury River to Taree.

GHD has always been involved with railways, but designing a track to traverse a firm foundation is quite different to placing a railway line over land which may decide to subside.

Subsidence in underground coalmining areas of New South Wales is not unusual. It seems logical that, if large underground blocks of coal are removed from below the surface of the ground, in the fullness of time there should be a chance that the earth will subside to fill the holes from which coal has been taken.

Homeowners in these areas take out special insurance against cracked foundations and damage from movement of the earth. Preliminary design of an access railway for the Birds Rock Colliery, in the western coalfields of New South Wales, showed that the preferred route was over an area which was subject to the danger of future subsidence due to underground coalmining operations.

The State Rail Authority of New South Wales does not usually build railway lines above such areas. The alternatives are to sterilise the coal beneath the railway route — this means a cessation of mining, leaving the valuable resource in the ground — or to re-route the railway to avoid the critical area. Any re-routing of a railway under such circumstances means additional track length to avoid the mining area, with consequent additional costs.
GHD-Wood Geotechnical examined the whole subject of building rail track over land subject to subsidence. Computer programs were developed to calculate and plot contours of three-dimensional ground surface movement due to longwall mining. The analysis took into account the depth and thickness of the seams, the number of seams mined, the width of longwall face and the stability of columns. Calculations were based on findings developed by the Department of Mineral Resources and Development, NSW.

The calculations included selection of railway grades, special features in bridge design, and stresses in rails for different methods of fastening rails to the sleepers. It was a new approach entirely to the subject of placing railway routes over subsidence-prone land by using the new sciences and technical expertise which has now been developed.

Results of the study were assessed by the State Rail Authority and approval in principle was given for the railway, even though mining subsidence could occur along part of the route.

GHD has also become a specialist in the simple matter of lighting. Good light in the factory can assist in the reduction of accidents and strain. Good light on the roads, in the home, in large buildings and so on, has become a very important factor in engineering design.

The need for improved lighting in older churches, to provide a worshipful atmosphere in a functional environment, is of concern to many parishes in Australia. As community standards change, lighting levels formerly considered satisfactory to churchgoers are no longer meeting the needs of modern congregations.

Such was the case with the Hoskins Memorial Church in Lithgow, erected by a pioneer family of the Australian steel industry in New South Wales as a memorial to a lost son. When it was decided to replace the building’s electrical system in 1982 GHD-Planner West was commissioned to investigate the lighting and recommend alternative schemes for upgrading.

Alternative lighting schemes were considered, including replacement of the original luminaires with pendant downlights and use of high intensity discharge lamps in the original opal fittings. For sentimental reasons and decorative purposes the original opal fittings were retained and fitted with modern long-life SL lamps. Quartz iodide floodlights were installed in the apex of the church to provide a twofold increase in lighting in the pew area and highlight the sanctuary as a focal point. Practicality of maintenance and relamping was a consideration in the choice of scheme.

By 1981 the South Bulli Colliery was producing 1.4 million tonnes of washed coal per year from its operation of four daily shifts, involving a workforce in excess of 1100.

In 1858, when the colliery commenced production, horse-drawn lorries were often used for the transportation of coal. Then, until the early 1960s, the coal was taken from the mine by rail to a coal loader at Bellambi Beach. When this operation terminated coal was taken by rail to Port Kembla, using the same route as far as the Main Illawarra Line. This system was replaced by the road transport system in which coal is trucked along the Prince
Highway to Port Kembla for export.

The New South Wales State government was also concerned with the problems of road transportation of coal, and this concern led to an investigation of alternative coal handling facilities by the Bellambi Coal Company Limited in consultation with the State Rail Authority. The key objective was to provide an environmentally acceptable and economically viable coal handling and transportation system from the Colliery to the new Port Kembla Coal Loader, as an alternative to the existing trucking system to the port.

A project team from GHD-Planner West was commissioned to investigate the alternative transportation options. It had before it the New South Wales government policy of maximising coal haulage by rail or conveyor.

The project had no simple solution. Pollution was to be kept to a minimum, but there was already pollution from the trucking system. The project, as visualised, complied with the basic issue ‘to get the coal off the road and on to the rail system’, but the coal still had to be conveyed to the rail point.

The final plan provided for an underground conveyor belt, pollution-free to the environment, to transport the coal to the rail loading point.

It was assessed that the implementation of the final design would provide an overall improvement in air quality in the area, have no effect on existing watercourses, maintain acoustic impacts within acceptable limits, improve both road traffic flow and safety and provide energy savings of 27 million megajoules or 700 000 litres of distillate annually.

Sadly, by 1986, the completed plan had still not been implemented. Falling market for export coal in the late seventies placed a delay on this and many other plans in the coal mining areas.

Warwick Keirnan and Jonathan Falk were involved in the environmental study and Brian Mahony and Richard Leunen with the mechanical engineering side of the project. All four were based in Sydney and they were supported by a strong in-house team covering all aspects of the plan. Meredith Rogers of Louis A. Challis and Associates acted as acoustic consultant.

Sydney office also has a strong project management team which in recent years has been commissioned to manage a wide variety of projects which include land development, housing estates, major buildings and engineering structures.

In recent times two very significant transport developments have been project managed by GHD, the first being the construction of the East Hills to Glenfield railway link. This project included the construction of two major bridges over the Georges River, eight kilometres of dual track and the building of two new railway stations, together with other minor bridges, signal works, landscaping, car parking areas and alterations to the major road system of the area.

This new railway line will be of great benefit to the residents of the Campbelltown area in reducing the travelling time to Sydney, and will also give the State Rail Authority more flexibility in the operation of the trains.
on the western and south-western lines. It is therefore a very significant addition to Sydney’s transportation system.

The other transport system which the Sydney office has project managed is the Darling Harbour monorail. Following the decision by the NSW government to accept the TNT submission for the building of the Darling Harbour monorail it was necessary to undertake the detailed planning and design for the route, its stations and maintenance facilities. Selecting a suitable route and locating the track supports presented many problems with all the underground services and tunnels in the City of Sydney. To design and build the monorail in time for Australia’s bicentenary required that the many facets of the project be closely coordinated. This role was undertaken by GHD as project manager for the monorail.

Both the East Hills to Glenfield railway line and the monorail project were managed by the Sydney office project management team with Ken Conway as the responsible director. The project team, which included Keith Furniss, Ray Higgins, Richard Ahern, Andrew Geddes and Tony Chapman, will recall the special effort given to these projects.

These are just some of the many and varied jobs controlled from GHD’S Sydney office and it would be tiresome to list what can be and is done — the list goes on and on — urban water, sewerage and drainage, hydrology studies, industrial projects, community buildings, every aspect of modern engineering. The list is so wide that some aspects, roads, railways, bridges and dams for example, have required special chapters of their own.

GHD in New South Wales is wont to say ‘If it’s an engineering problem, we can handle it.’
SOUTHERN QUEENSLAND

I ring the shovel down,
straighten from shoulder’s sag,
from toil’s intent and frown,
turn to the water-bag,
and fill, in this my spell,
the pannikin to its brink
with water from the well
and raise the cup and drink;

‘Deep Well’
Roland Robinson
(1912 - )

The Brisbane office of GHD services southern Queensland and portion of central Queensland, extending from the Queensland-New South Wales border to Rockhampton. In many areas and towns it is a byword for engineering expertise in its fields and in its services to clients. The Brisbane office could, perhaps, be called the ‘father’ of the Queensland practice. It was from Brisbane that the large office was established in Cairns and local offices in Southport, Maroochydore, Hervey Bay, Bundaberg, Gladstone and Rockhampton.

The Brisbane office in the immediate postwar years had a total staff of half a dozen people. In the two decades to 1985 it averaged one hundred people on strength. Ray Rose, a director of GHD who commenced with the practice in 1950, was appointed manager of the Brisbane office in January 1983.

In writing of the vast area of Queensland and the Northern Territory it has been thought practicable to provide separate narrations for both North Queensland and the Northern Territory, although all these areas operate as parts of the Queensland/Northern Territory Region, managed initially by John Keays and subsequently by Norm Traves, working from the Brisbane office.

The Brisbane office began in 1937 with a lot of hope but little else. It had no commissions on which to work. Perhaps it was not so much hope but keen judgment that prompted A. Gordon Gutteridge to open the branch. The office was situated in the Bank of Australasia Chambers on the corner of Queen and Wharf Streets and the manager, Mrs Rejnders, knowing her job, managed to bring in small commissions, mainly in the structural field.

Gutteridge saw a lot of potential in the future of Queensland and was prepared to gamble on his judgment that work in the sewerage field, his specialty, would provide the basis of a good practice. He was well supported
by Mrs Rejnders, an extremely competent woman, who had provided secretarial and administration back-up to Gutteridge from the time he had commenced in practice. She remained in charge of the Brisbane office until George Kerr replaced her in 1937.

Also in June 1937 the office began the design and construction of the Maryborough sewerage scheme initiated, among other reasons, to alleviate local unemployment. The Maryborough scheme was the first major project done on a partnership basis between Gutteridge on the one hand and Haskins and Davey on the other, this partnership having been established on 1 January 1937, but in respect of Queensland only.

The Maryborough scheme led to the appointment in 1938 of GHD as consulting engineers to the Burrum Shire Council, which then covered the rural and coastal areas in the Maryborough district. The original Burrum River water scheme was initiated to supply the coalmining towns of Howard and Torbanlea and the coastal area of Hervey Bay from Pialba to Urangan. The eventual size of the project is yet to be seen. GHD has designed and supervised three successive dams on the Burrum River, each larger and further upstream than its predecessor. Traves designed the first dam in 1947, Ron Penhaligon was involved in its construction. The second dam was designed in Brisbane and built under the control of Ray Rose in the early 1960s, and the third dam was completed in 1985 under the auspices of Brian Forbes.
Meanwhile the coastal areas have continued to grow, requiring more and larger pipelines, pumping stations and reservoirs, plus a treatment plant. The Burrum Shire appointment gave GHD a wide and practical experience in the operation and maintenance of local authority services. This all-round experience in infrastructure works provided the background on which the Queensland practice has been developed.

When Keays joined the Services, he was replaced by John Frew until the latter resigned in July 1941 to take up an important position with the Brisbane City Council. (Frew rejoined GHD in 1947 in Launceston.) The management of the office in Keays’ absence was carried out, in turn, by John North, Lew Thomas and Rex Anderson. On his return from the Services in 1946 Keays was placed in charge of the Queensland operations and later the Northern Territory operations.

Keays was a devotee of Gutteridge. He recalled that the potential in the sewerage field could be gauged by the fact that in 1946 only thirty per cent of the houses in Brisbane were sewered. It was an area which prompted action and under George Goffin, who had earlier been ‘Chief of Staff’ for GHD in Sydney, the Brisbane City Council embarked on major development in this field. Early in 1948 Goffin sought assistance from GHD in expediting the necessary detailed surveys, in which GHD had considerable experience from their work in provincial towns. A large survey organisation led by Mick Rochfort was built up under the technical supervision of Jim Trench, the firm’s partner in charge of surveying in Sydney. These parties carried out the detail surveys of extensive areas of the suburbs of Brisbane and were the beginning of a significant survey practice in Brisbane office that continued for over thirty years.

Clem Jones had been elected Lord Mayor of Brisbane on bread and butter policy issues including the speeding up of the installation of sewerage facilities for the residents of the city. The rate of expansion of sewerage works accelerated, and GHD was commissioned to design schemes for the Wynnum-Manly area and subsequently Sandgate and the northern suburbs.

Brisbane office in the immediate postwar years was located in tiny premises in Estates Chambers in Creek Street, now superseded, along with its neighbour, the old Gresham Hotel, by a tall modern building. The advent of Traves in 1947 increased the staff to seven in total and the office was bursting at the seams.

Major projects were designed in that little office, mainly outside Brisbane except for the metropolitan sewerage works. A sewerage scheme was designed for Redcliffe, which then proceeded to grow so rapidly that work continued for decades. Other sewerage schemes were designed and in due course proceeded for Bowen, Barcaldine and Aramac. Before long, the expanding Gold Coast area required sewerage and GHD was appointed for the task. The firm was obviously well launched in this field in Queensland, illustrated by the appointment in 1948 for the difficult but prestigious project in Cairns.

But activity in other fields was increasing. Design of the major Burrum River water scheme was in progress, along with extensive work for Bowen
and later the designs for towns like Mareeba and Atherton as requests for water supply work started to flow into the fledgling survey office in Cairns, to be designed in Brisbane. Designs were prepared for road and drainage and other municipal work for clients such as Burram Shire and Bowen Town, along with structural design of buildings. Mechanical and electrical work was carried out for the firm of Donohue, Cusick and Edwards located in another small office down the corridor, thus establishing a close relationship, particularly in work on hospitals throughout Queensland, that has continued to the present day.

The staff formed a hard-working, happy and democratic band in their efforts to get jobs out on time. Time sheets were unknown (fees were in those days on the traditional percentage basis) and many a time could two staff members, engineers or draftsmen, be seen working on one drawing simultaneously, one right-way-up and one upside-down, to complete it by the due time. The engineers, including Keays, made regular visits as required to supervise construction work, to centres quite remote from Brisbane such as Maryborough, Barcaldine, Bowen and Charters Towers.

Ron Penhaligon joined as a graduate engineer in 1951, and was later to work in Maryborough and Darwin before leaving to enter the field of local government. Ray Rose joined as a cadet engineer in 1951 and as soon as he completed his Diploma course, as a part-time student and with considerable distinction, was sent up to Cairns at the end of 1955 as the workload there was increasing rapidly. He took over the office in Maryborough in 1959 and remained there until 1971, when he moved to Townsville in charge of construction of the Greenvale-Townsville railway. On the completion of that project he finally moved back to Brisbane, again to superintend work being done for Burram and Kolan Shires in the Maryborough-Bundaberg area.

It seemed that all staff managed to be back in Brisbane on most Friday evenings, when tradition demanded that all should proceed to the below-ground bar of the old Gresham Hotel to review events of the week.

Philip Scott moved from Melbourne as partner responsible for the growing mechanical and electrical work and after Traves moved to Cairns in 1955 Bob Rivett and Geoff Sparks joined the office. With an increasing workload, including the survey operation, available space was an urgent need and Keays persuaded Davey to purchase a large house up on Gregory Terrace in 1956. This was home for GHD in Brisbane for nine years as staff numbers continued to increase towards the one hundred mark, and further commissions came in, covering virtually the whole range of civil engineering — swimming pools, major drainage schemes, roads, bridges, railways and still more water supply and sewerage work, along with mechanical and electrical work, mainly on hospitals and other institutional buildings, town planning schemes and survey jobs.

During the years immediately after World War II the volume and diversity of projects to be undertaken in Australia stretched engineering resources almost to breaking point. Not only was there a grave shortage of trained engineers, but also organisations and equipment for carrying out
investigations for the design of engineering works were simply not available on the comprehensive scale that they are today.

Innovation, short cuts and audacity were the order of the day where time was at a premium and, although such decisions would probably not be countenanced today, the engineers of those years got the jobs done and they were well done.

An example of an unorthodox approval typical of those days took place when an urgently needed major water supply scheme was designed in the Brisbane office. The scheme included several surface and elevated storage reservoirs to serve the various areas to be included.

Contracts were duly let and Norm Traves was sent off by Keays to supervise the construction of the reservoirs. The contractor was a busy man and wasted no time in transporting his machinery and team to the site. He proceeded to excavate for the foundations on a picturesque little hill on the edge of the town. Excavations of this kind are quite routine but the problem with this site was that, when the excavation was down to plan depth, and then below that, there was no sign of suitable material on which to found the water tower. The contractor sought instructions from Traves as to what action he should take and Traves rang his chief, John Keays, back in the Brisbane office. Keays was not unduly perturbed. He commented, 'What about the other hill, on the other side of town?' So the engineer, contractor and machinery crossed the town to the other hill and started to dig. Firm rocky material was encountered at a reasonable depth. Meanwhile, a quick check showed that the hydraulics of the system would be satisfactory with the reservoir in its new location, so up went the tower and tank without further problems and they stand there proudly to this day. As far as Traves could recollect, the contractor did not even claim extra payment for the change of site.

In the late 1940s and early 1950s, Keays became interested in town planning and the more orderly and efficient development which could flow from it. He was very successful in his promotion of this concept and obtained a number of commissions, including the preparation of town plans for Redcliffe, Southport, Surfers Paradise and Cairns.

There were many problems in the acceptance of town plans, with perhaps the most common being the inability of the community to meet the costs of preferred development, no matter how desirable. (This could mean, for example, moving one existing industry from an unsatisfactory location to a more suitable area.) In addition, the communities were not in the habit of looking very far ahead. They often found it easier to postpone decisions where the acceptance of a proposed plan meant expenditure of money or alienation of some section of the community.

Keays, Traves, Rose and Bob Goakes spent a lot of time with shire councillors and shire staff discussing the issues relating to the immediate and future needs of the communities. The approach paid off with an increased understanding of the issues by responsible people. One example of this was the relationship with local government in the town of Bowen. Dr Peter
Delamothe was elected Mayor and set out to develop the town; his town clerk, A.B. Moore, was enthusiastic and Keays and Traves became firm friends with the two and with the aldermen and council staff.

Keays and his team attended council and shire meetings regularly. Usually they were stereotyped and often quite boring, but not always so. The councillors of the Kolan Shire represented a mixture of graziers and sugar farmers who were miles apart in their thinking. The chairman of the shire was Tom Campbell, a wealthy and successful cattleman. Tom preferred to get his own way and usually did so but, at one meeting, after a fierce exchange of ideas and abuse, another equally wealthy and successful grazier walked around the table and began to fight the chairman. John Pender, who was then shire clerk, and John Keays (who was not a large man) tried to stop the fight and both finished on the floor. As is recorded in the Minutes — ‘the meeting broke up in disorder’.

By 1965, the Gregory Terrace house was overflowing and it was realised that this was not the most efficient form of office. The Institution of Engineers, Australia had just built new premises in Upper Edward Street for its Queensland Division and had considerable space available for rental. Keays and Rivett thought this was a good opportunity, so Brisbane office moved into two and a half floors of the building. With staff numbers over one hundred and still increasing, two sections — sewerage under John Ryan and mechanical/electrical under Keith Bell — had to be moved across the street to the Johnsonian Club building, which again was not the most efficient method of operation. So after another nine-year period, in 1974 the whole office moved to larger premises in a new building in Wickham Terrace where it remained until the end of 1986, with staff numbers apparently stabilised at a little over one hundred, but more and more space occupied by computers, automated drafting and other modern equipment. At the beginning of 1987 the office moved a short distance into new and larger premises in Astor Terrace.

Notwithstanding the more sophisticated surroundings and the increased technical complexity of many of its projects, the Brisbane office remains a somewhat informal and homely place, with ‘Happy Hours’ for all the staff in the office each six weeks or so, and cheerful gatherings of senior staff in the boardroom on Friday afternoons carrying out the activities traditional at that time of the week and informally discussing latest events.

There are still the busy rush periods when a report or set of tender documents has to go out on time, or a major proposal to a client has to be completed. On these occasions, all concerned pitch in to help or hinder the clerical staff to ensure that deadlines are met. Maybe the nature of the people in the office has not changed much from that which applied in Creek Street forty years ago.

Keays remained in the position of Manager, Queensland-Northern Territory, until his retirement in 1974 when Norm Traves became the director responsible for that area and Bob Rivett became Brisbane manager. Rivett remained in that position until 1977 when he was elected Chairman of
Directors of GHD.


The Queensland-Northern Territory Region of GHD has developed a system of small offices throughout the State and the Territory, which places an experienced engineer in each district. The system works well; Queenslanders are as parochial as people in other States and like to do business with a 'local'. The result has been, in effect, an almost family-type relationship between local authorities and the GHD team.

In another field, it is estimated that GHD has provided services for fifty percent of all hospitals in Queensland in the mechanical, electrical and hydraulic disciplines.

The Brisbane office has initiated many schemes which have been recorded in the North Queensland and 'Top End' chapters; the Cairns sewerage scheme, for example, the railway works from the Mackay Harbour to the North Coast line, and so on.

A 'first' for GHD in Queensland was the designing of the railway line to be associated with the incredible expansion of coalmining in that State. It was at Moura and was the start of mineral-line railway construction in Queensland, which continued for the next twenty years at an ever accelerating pace. The project was to build a line from a new mine to connect with the railway line to Gladstone, where the coal would be shipped overseas.

Bob Goakes, who had previously been the shire engineer of the district rejoicing in the name Banana Shire, knew the area well and was anxious to proceed with the job. His requests to the State Railways for information from its technical library met with little success; at that time it did not have a comprehensive library. A further request that Goakes be allowed to talk to engineers who had built railways in the State was equally fruitless. A railway hadn't been built in Queensland for probably fifty years or more and the last engineer to work on such a project had died some years previously.

Goakes started from scratch and designed the line and GHD, as project manager, was responsible for the complete job. Using contractors and day labour employed by the mine owners, he used earthmoving and other equipment from the mine and hired a platelaying gang with its equipment from the railways. This organisation built the lot, from fences to bridges and embankments.

With the building of the railway line assured, the mine owners then commissioned a water supply to be completed in one month. It was almost an impossible project but GHD accepted it and Goakes lost not a minute on the job with his team of workers. On the last day of the time allotted for completion of the project the men started early, with a thousand feet of pipeline still to be built. Goakes calculated that it should take about six hours for the water to come from the reservoir to the pipehead and at 11.00 a.m. he ordered the pumps to be turned on. His advice to the workers was to finish the pipe or suffer the consequences when the water flowed from the pipe in six or seven hours time.
The men worked without any break and completed the pipeline at dusk but water had not arrived. They went back to their camp exhausted but Goakes remained at the pipehead praying for the water to come. It did — at 11.00 p.m., just one hour before time was to run out!

A more recent project, the Curragh railway project in central Queensland, was a very satisfactory job in all respects for GHD, who completed the commission in July 1985. The project included the engineering design, construction and project management, on behalf of Queensland Railways, of a 14 kilometre railway spur from the central line just west of Blackwater to the new Curragh Mine.

The new project also involved duplication of certain railworks between Blackwater and Rockhampton, and Rockhampton and Gladstone. This latter project involved the purchase of rolling stock and other infrastructure such as housing, diesel servicing facilities and single men’s quarters. GHD was completely responsible for this project from the location of the route, evaluation of tenders, supervision of the construction by the contractors and the financial aspects — it was a total package.

Queensland, for GHD, has meant a very large involvement in the building and upgraging of the States’ railways in all their forms — passenger, freight, coalmining, resources and, of course, cane.

Sometimes interesting aspects arise for which the engineering approach is largely governed by time. Such a difficulty was met with the project to duplicate the Laleham Mine railway. The stipulation by Queensland Railways was that the line could not be shut down for more than forty-eight hours, and only one shutdown was permitted anyway.

The problem to be overcome was the removal of a tunnel which was wide enough to take the then single line and replace it with a cutting which would allow duplication of the line and give room for overhead electrification. The hill above the tunnel was excavated to within five metres of the tunnel top and, at a given signal, through holes previously drilled, the tunnel top was exploded, leaving 25 000 cubic metres of rock to be cleared from the track. The project manager for the Laleham line job was Ray Rose, with Ray Maxwell as job manager.

One large project designed by GHD-Planner West was the loading terminal, plus an access road and railway spur, for the Abbot Point coal-loading complex. This large infrastructure is part of an $800 million development by Mount Isa Mines. The job manager for the design was Rob Harrap of the Brisbane office, with Trevor Hazlwood responsible for materials handling design. Ron Last spent six months in Japan directing the design of the stacker reclaimers at the works of the manufacturer.

Ray Rose, an enthusiast in every way, saw the future for GHD in Queensland as even better than it had been in the past. He pointed particularly to the inevitability of the further development of resource-based projects in Queensland. In the field of pre-feasibility and feasibility studies for mining and similar ventures, GHD is at the forefront.

The Brisbane office of GHD, perhaps because there were in the prewar
years other pioneering consulting engineers already working competently in the general local authority field in southern Queensland, had to diversify its fields of practice earlier than did most other GHD offices.

This has been achieved as a result of a deliberate policy of building up expertise in areas of engineering beyond the original bases of sewerage and water supply, through the development of specialised engineers within the firm and, where necessary, recruitment from outside, even from overseas. The office is thus able to provide the necessary high-level assistance not only to
other offices in Queensland and the Northern Territory, but in some areas to offices in other regions of the organisation.

Sewerage has continued to be a major field, with activity tending more towards advanced forms of wastewater treatment as cities and towns have caught up with the backlog of unsewered areas.

Brisbane office was responsible for all the early sewerage design for the rapidly-growing tourist areas of the Gold Coast, which produced the initial encounters with the problems of sewer construction in coastal sand dune areas saturated with groundwater, coupled with urban expansion so rapid that the detail plans became out-of-date within months of compilation!

Redcliffe was a small town immediately after the war when GHD was engaged to design its sewerage system, but then grew so rapidly into a major city that for more than two decades the staff of Brisbane office was engaged almost continuously on the design of sewerage for further residential areas, further pumping stations and major augmentations of treatment facilities.

The City of Ipswich is another area in which GHD has designed the sewerage systems for large new suburban areas, and John Ryan and more recently Ken Hartley have introduced new, effective and economical forms of treatment in large plants to meet the requirements of an expanding population and the higher standards of final effluent required today.

Bundaberg is another city where GHD has been responsible for wastewater treatment plant augmentations for many years. The nature of the work has changed, but the firm appears to have maintained its position in the field of sewerage engineering in South Queensland.

Water supply work has continued similarly, with still further work on the Burren River scheme and work elsewhere mainly in the fields of more advanced treatment and the provision of storage reservoirs.

Brisbane has also expanded its capability in the engineering of dams, referred to elsewhere in this book, as earthfill, rockfill and more recently roller-compacted concrete dams (pioneered in Australia through the Copperfield Gorge Dam) have generally replaced concrete dams for reasons of economy. Brian Forbes, who was recruited from South Africa, and Glen Truscott, the firm’s principal specialising in geotechnical engineering, have been responsible for much of the recent work on dams.

Railway engineering has become a major area for GHD Brisbane, with John Buckley, a railway man from way back in New Zealand, working under director Ray Rose on major railway augmentation projects in central and southern Queensland, including the new main line electrification project for Queensland Railways.

In the fields of railways, and industrial and building works, Brisbane office has moved over recent years into the field of ‘project management’ in a major way. GHD has in fact been responsible for the full management of most of its large and small projects since the inception of the firm, but as computer-assisted techniques in management have been developed and popularised over the last decade, GHD has moved into the now formal field of project management and the provision of comprehensive project management
services. The provision of such services for the main line electrification project has been a major activity in Brisbane.

The science and art of hydrology — which deals with all aspects of rainfall, surface water and ground water and particularly the flow of water in natural streams and man-made structures — is of increasing importance in engineering, whether in relation to dams or bridges or the diversion of a river. A specialised group in Brisbane under John Lawrence, working in close cooperation with the experts in other GHD offices, has been attending to the hydrological problems of diverse jobs in Queensland and the Northern Territory for some years now.

Peter Rudd and Lincoln Davis have been heavily involved in the design of urban and rural arterial roads in Brisbane and elsewhere, which are a natural corollary to the extensive roadworks engineering by GHD throughout its history in Queensland.

The Brisbane office of GHD thus appears to be well equipped to handle the wide variety of work that it may expect to receive in the future.

A project of a different kind has been work with the Expo 88 Authority. During August 1984 GHD was commissioned by the Authority to examine development constraints for the forty hectare site on the south side of the Brisbane River and to recommend solutions to the engineering and environmental constraints that were identified. The Authority accepted GHD's recommendations and during 1985 the company was commissioned to provide civil engineering services to the project. The brief included traffic engineering, geotechnical engineering, site grading and related retaining walls, hydraulic services, the design of a magnificent water feature about one hectare in area, and construction phase services. The brief stipulated that all development works were to be completed by October 1987 to allow exhibitors
time to fit out their pavilions. Charles Guesdon, who moved from Townsville in 1982 to become manager of GHD’s Gold Coast office, became job manager for this work.

While Cairns and Darwin have for many years operated largely as separate entities, Brisbane continues to assist these offices with the services of expert groups in various fields, as it is not practicable to maintain specialists in all fields in all offices. This assistance from one office to another is quite important in GHD and operates between different regions as well as within each separate region. The Queensland-Northern Territory Region, because of its geography, is by far the most decentralised, with three main offices, each with their local branch offices.

Life in Queensland is never dull and the little town of Barcaldine is an example of a town where things happen.

Barcaldine stands on the edge of the black soil plains made famous by that magnificent painting ‘Across the Black Soil Plains’ by George Lambert. The painting is of a team of draught horses straining to pull a wagon loaded with wool bales. When it rains on those plains it takes more than horses to pull a wagon; powerful trucks and trailers bog down unless they are sitting safely on a metal road.

Adjacent to the railway station at Barcaldine stands a huge old gum tree which the locals call ‘The Tree of Knowledge’. They will tell you that, during the great shearers’ strike in the 1890s, the shearers formed the Australian Workers Union under the branches of this tree. The union was formed as a desperate measure to present a united front to the graziers with whom they were in dispute.

A long tongue of land consisting of wet flowing sand over hard rock snakes its way into Barcaldine, neatly dividing the town into two parts, black
soil and sand. The division is so distinct that the sandy end of the town is known as ‘the desert’.

Barcaldine is known throughout central Queensland as the ‘Garden City of the Central West’, a city of trees, shrubs and gardens. It blooms like an oasis in a desert but its verdancy is not an accident. Generations of dedicated shire gardeners, employed by far-seeing councillors, have maintained and expanded the area under trees and shrubs. It was, and is, a very distinct town.

In the middle 1950s, GHD was commissioned to design and oversee the installation of sewage treatment works and pumping stations as a prelude to installing a complete sewerage system for the residents.

The shire, which was not wealthy, received a fifty percent subsidy of the cost from the State government. The granting of the subsidy was a good move by the government in its fight to keep unemployment from rising. The contractor was required to use labour employed directly from the local employment office.

Problems began on the job almost from the start. The contractor for the treatment works and pumping stations had brought in all his equipment and his maintenance men but had not anticipated working in wet flowing sands and, worse, the rock beneath the sands, and this slowed his pace considerably. By the time the most difficult part of his contract had been completed he had decided to get out. The reason for his decision was, perhaps, that by shifting his equipment to another job, he could make more money. He believed he was making very little in Barcaldine.

It is not an easy thing to depart from a country town with all moveable equipment. A convoy of trucks would be visible to all.

In Barcaldine in those days, the big event of the week was the Friday night ‘pictures’ in the open-air theatre. The only people in the town who might be expected to be absent were the drunks and the seriously ill. Run-of-the-mill ailments, or such trifles as a broken arm or leg, were never enough to keep a person from the Friday night pictures.

Ralph Hawkes, who was representing GHD on the job, took his wife and three small children to the picture show this particular night.

At 7.00 o’clock on Saturday morning Hawkes rang the then Queensland manager, John Keays, to tell him that the contractor had vanished. Some tents had been left to present a picture of normalcy to the homegoing patrons of the ‘flicks’ the previous evening. The contractor had used the foreman to supervise the loading of the equipment and had paid off all his local employees.

The shire took over the balance of this contract and eventually completed it by the ‘day labour’ system.

Another contractor was appointed to construct the sewers through the town. He brought in a lot of equipment, but made the same mistake as had the first contractor — the equipment was not capable of handling the wet flowing sands and the hard rock beneath them.

Hawkes began to suspect that this contractor might also be planning to vanish in the night. The council had the usual powers under the contract to take over the contractor’s plant in the event that he did not perform
satisfactorily. Consultations followed hurriedly with Keays in Brisbane and the council's legal advisers confirmed the power to seize the plant. Alas, the contractor had already departed with his first load of gear, heading south along the bitumen road towards the unconstructed black soil roads further from town.

Hawkes and the local policeman gave chase, but fortune smiled on the contractor. By the time Hawkes reached the end of the bitumen, rain had set in, the road ahead was impassable and the contractor had gone.

Back in town the remaining equipment was duly taken over and used in the completion of the job.

The work proceeded with such day labour as could be found. There was a regular source of labour from the lock-up at Stuart's Creek. Each prisoner released from the gaol was given a travel warrant to Barcaldine and told to report to the local police station, from where he would be directed to the shire employment office. 'If there is a job vacant, they must give it to you,' the prisoner would be told, and so it was. Ralph Hawkes would visit the office of the employment agency and ask for three pipelaywers, two tunnellers, two mechanics and three tradesmen. Yes, they were available, 'Just came in on last night's train, as a matter of fact', and Hawkes would be saddled with a group whose mechanical experience had been limited to an occasional stint with a shovel.

To make matters just a little more difficult, a shearers' strike began over rates of pay. It was a ticklish position. Technically the shearers were not unemployed but were on strike, and the grazier-dominated shire council refused to accept them from the local unemployment office. The shearers were by tradition ferociously hard workers and in addition were used to cooperative team work. By all sorts of subterfuges Hawkes gradually built his gangs from these men and, although they had not had previous experience in sewer work, their reliability and team work speeded up the job.

Whilst the gangs were now excellent there were problems with maintaining the equipment as there were no backup facilities available. A positive threat to completion of the work was the continuous blunting or breaking of the jackhammer drills on the hard rock. The blacksmith with the previous contractor had gone his way and there was no blacksmith in Barcaldine.

In desperation Hawkes recalled that he had been given a short course in blacksmithing while in the Navy so he and an ex-policeman, Danny Danfield, started up the forge one day and, by trial and error, learned how to sharpen the jackhammer drills.

The job was completed amidst great rejoicing. Jimmy Bennett, the shire chairman, made kind remarks about GHD and its ability to overcome difficulties and shire clerk Dawson Phipps, also a friend of GHD, applied for a more senior post in the Gatton Shire Council and got it partly perhaps on the strength of the completion of this project.

There is an aftermath to this story, as there usually is to any tale.

There lived in the town one Chundah Urquhart, a tailor who sat on his
table, cross-legged, all day and made excellent suits. Chundah was one of the three councillors representing the townspeople and was very proud of his part in helping them abolish the nauseous ‘night cart’ system.

There also lived there Francis Collins, known as Francie. Francie was the head gardener of the shire and was proud of his gardens, as well he might be. Francie discovered with delight that the end product of the sewerage project was a continuous supply of dry, odourless sludge, a first-class fertilizer for his beloved gardens. He loaded his old council truck with sludge a couple of times a week for his gardens. It all came to a head at a shire meeting.

Hawkes was at one meeting when Chundah Urquhart burst through the door steaming with rage. Chundah had been walking up the beautifully-bordered path to the Shire Chambers when he saw Francie Collins shovelling a dark mass onto the garden from a wheelbarrow.

‘What’s that, Francie?’ asked Chundah.
‘Shit, Mr Urquhart,’ was the reply.
‘What?’ said Chundah, ‘You mean to say that is shit?’
‘Yes, Mr Urquhart, shit!’ And Francie spelt it out, ‘S-H-I-T’.

When Hawkes saw Chundah come through the door of the Shire Chambers, he sensed that something serious was amiss.

‘Mr Chairman, Mr Chairman,’ said Chundah, ‘may I interpose please? It is important!’

Jimmy Bennett was taken aback but was a kindly man and saw that Chundah was agitated.

‘Yes, Councillor Urquhart, what is the trouble?’
‘Mr Chairman, I was one of the prime movers in originating the shire’s sewerage scheme. For years we had put up with the pan system and all the nauseous problems it gave us. We have now spent more than one million pounds to have the nightsoil taken two miles out of town so that we will be rid of this problem for ever. Am I right, Mr Chairman?’

‘Too damned right you are, Councillor, but what is the problem now?’, replied Jimmy Bennett.

‘Mr Chairman, after paying over one million pounds to have the nightsoil taken two miles out of town, I now find that Francie Collins is bringing it back by the truckload and, to make matters worse, tonight I found him shovelling shit onto a garden not ten yards from where you are now sitting!’

Uproar!

And somebody has tried to suggest to me that Queensland is no longer a frontier State!
The people of North Queensland periodically advocate that they should have a Statehood of their own and to visit there one can understand some of the reasons behind their attitude. Brisbane, the capital of Queensland, is a long way from their territory and the rest of Australia seems to stretch into the mists of time. The people of North Queensland are virtually on their own. The climate there is seen by many Australians as harsh and tropical, but the North Queenslanders don’t see it that way. Their ‘country’ ranges from thick jungle to flat plains, from high ranges to shallow seas. It is a rough country which, in many ways, wishes to control its own destiny. The people are fiercely independent and are descended from, and still are, pioneers in every sense of the word, although they may not now admit it.

Some of the people of North Queensland have a tendency to resent the ‘frontier’ picture which many Australians have of them. That could be a pity, as this may be one of the great attractions to visitors from other parts of Australia and overseas.

Cairns and Townsville are modern cities with modern buildings and all of the western amenities and yet, in Cairns particularly, Aborigines and Torres Strait Islanders are visible everywhere. The streets of the cities abound with pretty girls dressed in skimpy clothes to meet the heat. Young sun-tanned men, and older men too, wear wide-brimmed hats to ward off the glare. The
same hats are worn in the blistering heat of the outback. The fierce sun is so strong that North Queenslanders have the highest incidence of skin cancer in the world but still they love their State and would live nowhere else.

The incredible ‘bush pilots’ who carried mail, supplies and people throughout North Queensland without navigational aids other than good vision, and who landed their frail craft on runways roughly hacked from paddocks, are now ‘Air Queensland’. They, too, wish to present a sophisticated image, although they still need all their skills to service the outback.

GHD has been closely connected with the development of the north and its people for a long time. It has had to be that way because in sparsely populated areas people depend upon one another and large projects can only be completed by cooperative effort.

The services of consulting engineers were urgently needed in North Queensland over the two or three decades after the end of World War II. This had been in many ways a neglected area in respect of public works in the prewar years partly, perhaps, as a result of the depression. Naturally little had happened during the war years except for the construction of airstrips
and some roads and swamp drainage works carried out to meet requirements associated with military purposes.

GHD has provided the bulk of the necessary services through the postwar years and to the present, in the area referred to as Far North Queensland — from Townsville or thereabouts, north along the fertile tropical coast through Cairns to Cooktown and the Peninsula, over the whole of the Atherton Tablelands and across to the Gulf. Indeed GHD has carried out significant work for every local authority from Bowen north, and across to the Gulf.

In the immediate postwar years no city or town north of Townsville was served by a sewerage scheme. The cities and larger towns had water supply systems but most of these were in need of major augmentation, often including new sources of supply. Many of the smaller towns had no public water supply. Notwithstanding notable achievements in earlier years, such as the roads ascending the coastal ranges from Innisfail, Gordonvale, Cairns and Mossman, the road system was in its infancy, with the main highways constructed only to indifferent standards and secondary roads, particularly away from the settled sugar-growing areas, often only unformed tracks. Municipal amenities such as swimming pools were generally absent. None of this was the fault of the pioneer engineers, who had achieved results remarkable for their time.

The scene was thus set in this area, perhaps more than most other areas in Australia, for a high degree of activity in engineering development, particularly civil engineering related to public works.

Engineers were in short supply in Australia after World War II and particularly so in the more distant regions far from the tertiary institutions which produced them. Some of the local authorities had a city or shire engineer but most relied upon overseers or foremen.

The trigger for GHD to enter this scene, having worked from Brisbane only as far north as Bowen and Charters Towers, was the awarding to GHD of the commission for the Cairns sewerage scheme in 1948. The magnitude of this scheme is dealt with separately in this chapter, but it naturally followed that contact was made in due course with the neighbouring local authorities on the coast and on the tablelands. All had lists of works to be implemented when funds and materials became available (very relevant in view of the shortages of supplies in postwar years). GHD was able to provide the necessary engineering in addition to surveys and John Keays, as manager of the practice in Queensland, sent Norm Traves to Cairns in 1955 to establish an engineering practice there.

Water supply schemes were the major jobs in the early years while funds were awaited for Cairns sewerage. Major augmentations of existing schemes were designed and the construction of necessary works supervised for towns like Mareeba, Atherton, Ravenshoe, Herberton, Innisfail and Ingham, and new schemes for towns, particularly on the tablelands, such as Yungaburra, Millaa Millaa, Mt Molloy, Kuranda, Mt Garnet and Kairi and, further afield, Cooktown, Georgetown and Croydon. In later years major ‘district’ schemes were designed, notably for the Mossman-Port Douglas and Wonga-Whyanbeel
areas of Douglas Shire and the Smithfield-Northern Beaches area of Mulgrave Shire. Some of these schemes included water treatment plants which had not previously been seen in North Queensland.

The succession of sewerage schemes continued, alongside the major project in Cairns for which augmentation work will continue to proceed as the city and surrounding areas expand. Mareeba and Ravenshoe on the Tablelands, and Gordonvale, Babinda, Ingham and Innisfail on the coast, all had their sewerage schemes surveyed and engineered by GHD.

Councils turned their attention to further amenities, and swimming pools for Cairns, Mareeba, Atherton, Tully and Cardwell were added to the list of GHD projects, together with all manner of major drainage schemes, sports fields and the like.

The Main Roads Department and local authorities which did not have their own engineers turned to GHD for assistance in their road and bridge works, and hundreds, eventually thousands, of kilometres of rural arterial, secondary and access roads were surveyed and designed, including the many bridges involved.

Many building projects were handled by GHD, including the Cultural Centre and other major buildings in the City of Cairns and, importantly for North Queensland, a group of large silos to hold malt at the Cairns Brewery!

Through the seventies and eighties the nature of the work handled by GHD in North Queensland tended to change gradually. Most of the towns have reasonable water supply and sewerage services and the road network has improved out of sight since the 1950s. Local authorities and government departments have built up their engineering strength and many other consulting practices have been established.

Traves handed over to Goakes in 1973 and he, in turn, to Adcock in 1978, as manager of the North Queensland practice, with Henry Friend as manager of the Cairns office.

Over the years, as the number of staff increased to meet the workload, the office of GHD in Cairns moved progressively to larger premises.

Ken Smart’s small group, mainly survey staff working on the detail surveys for Cairns sewerage and the early water supply jobs on the Tablelands, was located in Shields Street in premises above the chemist’s shop of W.A. Collins, at the time Mayor of Cairns. In 1953 it moved to smart new rooms at the top of the Starr Bowkett Building in Lake Street, but with the office starting to handle engineering design, space became too small and a move was made to much larger premises in the old T & G Building in Abbott Street in 1955 when Norm Traves transferred from Brisbane. The building was rather poorly ventilated and conditions, particularly for draftsmen working on linen plans, were not conducive to efficiency.

In 1960, with over twenty staff in the office, envious eyes were cast towards the new CML Building around the corner in Spence Street, on which GHD was carrying out the engineering supervision. This was the first air-conditioned office building in Cairns, and all concerned were happy to move to these new premises. During the 1960s, staff numbers increased even more
rapidly with work on the ‘beef roads’ and sewerage schemes and a wider variety of municipal and other jobs, and gradually GHD took over virtually the whole of the two floors of the building, with an overflow office around the corner.

Bob Goakes located a larger area available down the street, and after air-conditioning was installed there, the office staff by then numbering nearly one hundred moved in 1973. Here they remained, with numbers reducing to some degree through reduction in volume of survey work and transfer of some engineers and draftsmen to branch offices such as Townsville, until in 1984 Henry Adcock organised the construction of GHD’s own handsome office building, designed by GHD staff, a little out of the central city in McLeod Street. The firm had come a long way in Cairns since its first small office was opened thirty-six years earlier.

The work of GHD has tended to become more technically complex and less of a pioneering nature as more routine work is handled by others. More advanced technology has been applied to water and wastewater treatment plants and in recent years to major projects such as the Cairns airport, high-standard cane ‘tramways’ in the Burdekin and Proserpine areas, the dams and associated works for the extensive Kidston goldmining project, tourist developments and so on. But still the work on ‘bread and butter’ jobs continues, with ongoing work in the fields of water supply and sewerage for various local authorities, town and regional planning, surveying, structural engineering and mechanical services for buildings, rural roads and town streets, full engineering services to several shire councils, tourist developments and work in the industrial and mining sections of private industry.

![Image](image-url)

*Ivan Luscombe, Rod Shore and Bruce Bettany: veterans of surveys throughout North Queensland.*

Surveys have from the early days constituted a significant part of the work of GHD in North Queensland, and through the late fifties and sixties
in particular a large survey organisation was built up under Don Michael. These survey teams handled a large volume of property surveys but, more importantly, carried out the necessary engineering surveys for sewer systems, water pipelines, roads, bridges and railways throughout the Far North, up the Peninsula and across to the Gulf.

For work in the more remote areas the establishment of camps for major surveys was quite a task, involving tents, the cook’s galley and equipment, fuel supplies, water tanks, refrigerators and, in later years, mobile generators and water pumps.

The tasks of the survey parties involved more than simply surveys, and often included putting down bores and digging test-pits to determine foundation conditions, gathering information on stream flows and searching for materials to be used in the later construction.

Over the years the trend of survey work now under the control of Ivan Luscombe has been parallel to that of engineering. Aerial mapping for route location and the use of modern equipment and methods have made the task of the surveyors generally less arduous, while the increasing network of roads has reduced the problems of access in many areas. Adequate survey information, however, remains an important first step in most engineering works.

It was in North Queensland that I really came to understand the links that obviously bind GHD and local government so closely together throughout Australia. The relationship which began and was fostered by Gordon Gutteridge in the 1930s in Victoria and Tasmania is an ongoing attitude, common to all areas where GHD offers its services.

In one day I talked with three people in three different shires in North Queensland. They were all of different backgrounds but all had reached positions of distinction in their respective spheres; they all talked to me of their close partnership and of the valuable assistance they had received in their public life from the engineers of GHD.

The first person to whom I spoke was Cecil Holdcroft, ex-chairman and councillor of the Herberton Shire Council for more than forty years. When I saw him his giant frame was no longer covered in muscle; he was more than eighty years old, but Cecil still stood as straight as a stripling. His strong voice came from the Henry Lawson era; rough, clear and distinctively Australian.

Cecil came from a family of nine children and left school at twelve years of age to care for seventy horses in a Cobb and Co staging camp in the ‘back country’ of northern Queensland. The horses were grass-fed and mostly unshod. Cecil tried to maintain the horses in teams — ‘they worked better that way’ — and he made such a success of his job that at the age of thirteen years he was promoted to the position of driver of the luggage and goods coach which always followed the passenger coach. Cecil drove coaches across the Queensland ranges, up to fifteen miles per stage, and became a byword along the Cobb and Co route. Years later in a re-enactment of the old company at work, he drove an actual coach, a five-in-hand, along the same route as
originally but now converted to a developmental road, or beef road, designed by GHD.

Cecil became a power in the Herberton Shire and plunged into public life for four decades. He fought for his shire, not a rich one, and brought roads, electricity, water supply, sewerage and other amenities which had previously been only a dream to the people of his district. His gracious wife worked with him as a public figure and brought a new dignity to the women of the district.

Cecil’s greatest problem in building his shire was the lack of money. It was a sparsely populated district and money was hard to come by. Cecil and his councillors could not afford the luxury of a shire engineer so they appointed GHD as consultants; it was not much different from having their own engineer anyway, but a lot cheaper. An engineer from GHD would attend every council meeting, year in and year out, and discuss the shire’s engineering needs with the councillors. Projects would be gone over and over in simple language until every person present knew exactly what had to be done, how long it would take to complete and approximately how much it would cost.

The family relationship still exists today. One of the rewards of a writer is in meeting special people; Cecil Holdcroft was a very, very special person. I was saddened to hear of his death a few months after I had talked with him. Cecil’s death was the passing of an era.

There was an aftermath to my meeting with him. I recommended to the Australian Broadcasting Corporation that they interview Cecil. They did so and produced a fine radio documentary of Cecil’s early days. His rich gravelly voice has been preserved as a part of Australia’s heritage.

The second person I met that day was Stan Collins, a retired grazier. In background he was at the other end of the line from Holdcroft. Stan was the son of a pioneer grazier and admitted that some had said that ‘he had been born with a silver spoon in his mouth’. Well, he had, but his dad was a hard worker and brought Stan up as he himself had started, as a jackeroo. In working for his father he received no concessions beyond those given to other station hands. Collins was educated at a private school in Brisbane and graduated with a Diploma in Livestock from Gatton Agricultural College. The rough life of a jackeroo taught him to respect people for what they were and he was determined to make the Etheridge Shire, a vast one with few people, a more comfortable place for its residents.

Like Holdcroft in the Herberton Shire, he threw himself into public life, became Chairman of the Shire, was Chairman of the Cairns Regional Electricity Board and a galaxy of other boards, and held appointments in other areas ranging from the bush pilots to the meat industry.

His problems in the Etheridge Shire on which he served for twenty-seven years, eighteen as chairman, were the same as for Herberton; too much to do and too few residents to pay for it. Stan followed a parallel path to Cecil Holdcroft; his councillors appointed GHD as consultants and, as in Herberton, a GHD engineer made the long trip from Cairns to every shire meeting, sat with the councillors and dissected and explained every project. Stan Collins spoke fondly of ‘a young fellow from GHD, Ralph Hawkes, who not only got
on well with the road gangs but if time was running short would get in and work with them'. 'Ralph Hawkes,' he said, 'spent a lot of time teaching surveying to the council staff and explaining the rudiments of basic civil engineering problems which the gangs would meet in their shire work'.

The councillors of the Etheridge Shire have more people to pay rates now, but they still work with GHD in a family-type relationship which stretches back for decades.

My last talk on that day was in the bustling town of Mareeba, a prosperous, lively place. It had not always been so and Ralph Arnold, retired shire clerk of Mareeba, told me a similar story to that which I had heard twice before on that day. 'There were,' he said, 'just too many jobs to be done and too few people to pay for them. Our solution was to appoint GHD as consultants, rather than stand the burden of employment of our own engineers.'

He repeated what my two previous interviewees had told me: there was always a GHD engineer in attendance at shire meetings to patiently explain and offer advice on the best methods and the economics of using them. Whereas Stan Collins remembered with some affection the assistance of Ralph Hawkes, a junior technician, Arnold recalled that it was the manager of the Cairns office of GHD, Norm Traves, who saw him at least once a month to discuss progress and to iron out problems.

GHD in the north has been involved in every type of engineering project one could imagine, including jobs which one would not expect from engineers. Magnificent structural projects are permanent monuments to their expertise but, like the people of the north, the staff of GHD have had to pioneer their way. Here are some of the more unusual areas in which they have contributed to the development of North Queensland.

Although GHD had been in Bowen for some years previously, it was the famous Cairns sewerage scheme which took the practice to the northern part of the State. Hence Cairns was GHD's first branch office to be established in North Queensland.

When the job was received at the Brisbane office, John Keays sent Ken Smart with a team of surveyors to Cairns to survey the city for sewerage development. Smart, who had worked for GHD from the time he had completed his schooling, had previously worked on major surveys in Victoria, Tasmania, then in southern Queensland. In 1948 when the survey commenced, Cairns was the largest city in Australia without sewerage facilities. The city had been investigated several times for the introduction of sewerage, but the extremely difficult site and the consequent high cost had always deterred the city fathers from accepting what was to be inevitable, the implementation of a sewerage system.

The terrain of Cairns has few counterparts in Australia. Previously a large mangrove swamp, the winds have blown sand over it for thousands of years to form a series of sand ridges separated by swamps, the whole area being just a metre or so above sea level. The depth of the sand is an average of eight feet (2.4 m) and rests on about twenty feet (6 m) of primeval mangrove
mud. The immediate consequence is that foundations for any type of construction are extremely fragile.

An equal problem for GHD was that of the level of the watertable. In most of the area under survey the table was about a metre below the ground surface but in the ‘wet’ season in some of the low-lying areas the table was actually above the ground surface.

To add to the problem of excessive water below ground level it was found that the water was aggressive to concrete pipes due to the presence in it of free carbon dioxide and its low ‘hardness’.

Each problem was considered in its turn and was overcome.

In the very first instance, to enable the construction workers to dig the trenches to take the sewerage pipes it was necessary to install an elaborate system of ‘spear points’ (water pipes with screens screwed into the ground) to pump out sufficient water to allow the initial trenches to be dug.

Next in line were the foundations, and crushed rock or timber supports were used to provide a measure of solidity on which the pipes could rest.

The selection of pipes for this unusual scheme was another headache. Earthenware pipes were ruled out because in those days cement mortar was used to join such pipes and it was considered that any shifting of the pipes could crack the mortar. There was also the problem of the aggressive water which would attack the relatively weak mortar and enter the sewer system.

The engineers decided to use concrete pipes and join them with rubber rings, a system not previously used in Queensland. To protect the pipes from attack by the water, various bituminous and tar-based finishes were tried and finally the pipes were coated with an enamel based on coal-tar pitch. In some areas the pipes were actually protected by a clay surround found locally in the hills behind Cairns but again, many types of clay were tested to ensure
that the clay itself did not attack the concrete pipes.

Another departure from the more conventional sewer system found in most towns was the large number of pumping stations required due to the flat terrain on which the pipes were laid.

The original design for this unique sewerage scheme was prepared by John Keays, who was nominally in charge of its implementation until his retirement. Norm Traves, the engineer on the spot, and John Ryan, his deputy, were able to develop further Keays' ideas as the never-ending problems arose, and later Henry Friend took over from John Ryan and succeeded Traves in this continuing and massive scheme when Traves, in turn, left Cairns for Brisbane. The Cairns scheme was so large that Friend, in the years since the original plans were designed, met with a great deal of technological changes and incorporated them within the scheme as the need arose.

A postscript to the Cairns sewerage scheme was its transfer to paper by Norm Traves. There was such interest in the scheme among sewerage engineers that Traves committed it to a thesis which won him a Masters Degree in Engineering from the Queensland University, the university from which he had originally graduated.

To the far north of Cairns GHD has played a valuable role in the beautiful islands of the Torres Strait. The islands are an important part of Queensland. Three of them, Thursday, Horn and Prince of Wales Islands which lie close to Cape York, constitute the Shire of Torres, while fourteen islands are situated in an area 140 kilometres north and 210 kilometres east of Thursday Island.

These islands are each an Aboriginal reserve under the control of the Queensland Department of Aboriginal and Islanders Advancement (DAIA), and each constitutes a local authority as a community council. One of the most important problems for the Torres Shire is that Thursday Island has a growing population which will one day be too large to be accommodated and serviced on the small island.

In the years 1974-79, when the Federal government increased financing in the area to provide basic facilities to the islanders, GHD was involved in project management and engineering works of a novel type not usually encountered anywhere else in Australia.

Historically, the community councils have been funded by the DAIA to provide minimal community services such as the operation of water supply, sanitary service, garbage cleansing and general village cleansing. Community members traditionally provided their labour on a day basis, without payment, to assist in council works. This was considered as work in lieu of any form of council rate payment and was called Village Day. The system seemed to work well.

Capital works in the seventies were funded by the Federal government after all the appropriate procedures had been followed, that is, an initial approach by government officers and an estimate of cost supported by preliminary design concept by an engineering or architectural consultant.

A comprehensive survey was carried out by GHD in 1974 to investigate
needs and establish priorities. The results were quite startling and included a wide range of projects.

A serious problem for the islands was the almost total lack of landing facilities for both travellers and materials. Only three islands had airstrips. Not one of the islands, except Thursday and Horn Islands, possessed a wharf or pier and all materials transported by sea were transshipped by dinghy from vessel to shore. This latter method involved manhandling cargo at the beach, in most cases over coral reefs, which severely limited the weight and size of cargo.

GHD suggested that, as rudimentary airfield construction was beyond the scope of the island councils and because on some of the islands there was no room for an airstrip, reinforced concrete helipads would provide an interconnecting service between the islands. This service would be particularly valuable in the case of urgent medical attention and in situations where natural disasters such as cyclones would cause problems.

Helipads were provided on the fourteen inhabited islands but it would be churlish to disregard the problems which were met. Cement and steel were shipped 1000 kilometres from Cairns and then for distances of up to 200 kilometres to the islands by a small barge or lugger. GHD engineers did the job.

To facilitate transport of materials from boat to beach, boat ramps were constructed on six islands, with long approaches over the coral reefs. There were special problems here too; the ramps were constructed of coral rocks with a packed and rammed traffic surface relying on natural cementation of the coral.

To provide adequate transport facilities for the area GHD recommended that a new vessel be built to service the islands. GHD designed the boat; it is mentioned elsewhere in this book.

Water has always been a problem in the Torres Strait Islands due to the nature of the terrain and it is believed that this has always been a limiting factor in the growth of island population. Traditional village wells yield small quantities of water and on a number of islands it has been common dry weather practice for the residents to travel to other islands by canoe or dinghy in search of water.

With some of the islands which have been formed from granite or basalt rock, it has been possible to improve and develop supply sources by deepening wells and constructing collection drains to concentrate the yield of small springs and soaks. Water from these services is pumped to a galvanised steel prefabricated squat-type tank.

The developed water supplies are more reliable than those of a few years ago but during the four-month dry season they provide only ten percent of the water which is available in the average Australian community.

Beachfront erosion has always been a problem in the islands. It has been dramatically halted by the use of groynes, using lightweight coral or limestone rock contained in gabion baskets. Heavier material is unavailable and, even if it were available, the islands do not possess the equipment to use it.
Prior to commencement of Federal funding only three islands had any form of wheeled transport and roads were merely walking tracks marked out with boundary stones, with small timber footbridges. GHD designed and oversaw the building of roads and bridges, often through swamps and poorly drained areas. The terrain brought problems in construction but these were met and overcome.

The construction of even basic buildings to house equipment and store materials and tools became a nightmare when every piece of equipment and the material itself had to be shipped from Cairns. At the end of the journey, because of the size of the barge, it was not possible to completely beach the vessel and all materials were unloaded, mainly by hand, in water up to waist-deep. The cargo was then placed in unsorted heaps above the high tide mark and covered with tarpaulins.

Nine houses, two workshop/store sheds and some community buildings were completed under great difficulties. It was a start, however, and demonstrated that with goodwill, good design and a great deal of resourcefulness, more and more works could be completed.

GHD is justly proud of its efforts in the Torres Strait Islands. All staff of the Cairns office were involved but special mention perhaps should be made of the dedication and sympathy for the islanders of Grahame Bruce and Ralph Hawkes, who made the original survey of their needs. Cooperation was given freely by government departments and officers, especially Ken Munroe and Tom Baker of the DAIA. Jim Callum has been in charge of these projects in recent years.

One of the most exciting facets of the exploration of North Queensland, and indeed Australia, has been the area of Weipa. It was there in 1957 that Harry Evans discovered one of the world’s biggest deposits, if not the biggest, of the magic bauxite. It was a discovery beyond the dreams of Croesus and yet the bauxite was worthless unless treated; an important factor of some phases in the production of aluminium is water.

GHD was called in within a few short months of the discovery to find a source of water, 36 million gallons (164 million litres) per day, as a prerequisite to the establishment of an alumina plant which would turn the red bauxite into yellow gold.

Norm Traves, then engineer in charge of the North Queensland practice, was given the job. There were no roads in the relevant area of Cape York Peninsula so initially, in a Bush Pilots’ Auster Aircraft stationed at Weipa, he flew up and down all the rivers in the central peninsula looking for dam sites. He found two possible sites, one near the head of the Wenlock River above the location of the old Batavia (Wenlock) River Goldfields, and another further downstream towards Moreton Telegraph Station. There also appeared to be another site for an additional dam on Sefton Creek. Geoff Davey came and looked at the area from the air and agreed that these sites had possibilities. Bruce Bettany, surveyor from GHD Cairns office, led a ground party with one four-wheel drive vehicle from Weipa through to the old mining village. Three ancient miners were the last inhabitants of this once busy
mining town. They were living replicas of the Henry Lawson image of the goldminer of the nineteenth century, content to end their lives there, still hoping perhaps for the ‘big strike’. One feels for what would happen to the peaceful existence of their lives were such a strike to be made.

A tiny prewar airstrip was cleared by dragging a heavy iron tyre from an ancient bullock wagon behind a Landrover. It was not the most modern clearing tool but it sufficed and Norm Traves and John Ryan were able to fly in to the bumpy strip with Bush Pilots. The airstrip provided a route for supplies and a means of emergency communication from then on.

The party explored upstream from the old mining village for about 24 kilometres and located the potential dam sites which had been spotted from the air. It was rough inhospitable country and the small group under John Ryan spent two or three months investigating both the upper and lower sites on the Wenlock River. The plan envisaged release of the water downstream some 300 kilometres to a diversion weir near the limit of tidal waters on the Wenlock River. From this weir water would be pumped some 72 kilometres to Weipa at the rate of 164 million litres per day to a terminal storage. The work was done mainly in the winter months and the men suffered from the cold at night. The area in which they were working was a long way from the warming waters of the sea.

On one trek through the bush Traves and his men met the last packhorse mailman in Australia. He ran a mail service from Coen up the overland telegraph line to Moreton Telegraph Station. It took him three weeks, weather permitting, to do the trip with one Aboriginal offsider, twelve packhorses and numerous dogs. This unique character, an important part of the old bush life, has now vanished into Australian folklore and his mail run was won by the Bush Pilots, whose light aircraft carried mail direct to the station owners with their private airstrips.

The GHD team used a two-way radio for emergencies and to order supplies, but it was a lonely period. Up to eleven men were transported on the one four-wheel drive vehicle, with nobody but the three old miners and a handful of nomadic Aborigines within 200 kilometres.

Subsequently in 1970 more detailed examinations of the Wenlock River dam site and the adjacent Sefton Creek dam site were carried out. By this time movement was a little easier and an airstrip was constructed for the purpose, adjacent to the possible sites. A bulldozer was taken in to enable some examination of materials to be made and a more detailed feasibility report on the whole scheme was prepared.

The project was deferred in favour of the conversion of the Weipa bauxite to alumina and thence to aluminium at Gladstone. At some future time further processing may be located at Weipa and the major water supply project may yet eventuate.

Since the inception of the Weipa project GHD has carried out extensive and varied engineering works for Comalco and its predecessors. These have come to fruition and have constituted a significant contribution to this major mining development.
An interesting challenge early in this history of Weipa was how to answer the question, ‘Is it possible to make satisfactory concrete using bauxite as the aggregate?’ John Ryan, then in the Cairns office, carried out detailed investigations and testing which showed that, with careful attention to the mix, it was in fact practicable to produce bauxite concrete suitable for almost all purposes, and this has been normal procedure at Weipa ever since.

The question of foundations for the various types of structure was important in the new development, so Ray Rose and Norm Traves had lots of fun carrying out experimental investigations on site with different types of spread footings and bored and driven piles. Later, Henry Adcock was responsible for further investigations and analysis which led to the production of a document that became virtually the ‘Bible’ for foundations at Weipa.

GHD was responsible for much of the engineering for the new airfield that replaced the old Weipa Mission strip, while survey teams under the direction of Don Michael for years carried out nearly all the surveys required for the planning and implementation of the whole mining project.

As the workforce increased and settled in permanently, a town was required, so GHD was engaged for the surveys, planning and engineering of the new town on virgin land at Trundling Point, on Mission River. Later Bob Goakes was responsible for the planning and engineering of the further town of Weipa South, where most of the local Aboriginal people now reside.

The largest single monument to GHD at Weipa came later when Comalco wished to transport bauxite from the Andoom area north of Mission River. Rail transport was decided upon and GHD was engaged to design a combined rail and road bridge for heavy loads across the wide estuary of Mission River. This was a real challenge. Economy was vital to the mining operation and, in fact, the half-serious instruction from Ray Roberts representing the client was that the bridge ‘has to fall down as the last trainload of bauxite is transported across it in thirty-five years’ time’! Henry Adcock was in charge of the design from Cairns office and produced an impressive and economical design with careful attention to availability and cost of materials in that very remote area, using steel, precast prestressed beams barged round from Cairns and substantial quantities of the famous bauxite concrete. The bridge has performed to all expectations, and appears to have a deal of life left!

In the nineteenth century and right up until 1924 the principal means of fast communication in much of North Queensland was by Cobb & Co coach. Coachmen drove their horses, up to six-in-hand, to a regular timetable through some of the most inhospitable country in the world. They drove through rough granite country, through bush and arid plains and carried mail, passengers and small supplies to the lonely outback.

Project engineer for the bulk of the roads designed, built or surveyed by GHD in North Queensland was Grahame Bruce of the Cairns office. Grahame was justly proud, in his quiet way, of the part that his firm has played in opening up for development the great outback of northern Queensland. An engineer with a sense of history, he was rather humbled by the fact that much of North Queensland had still not felt the tread of a white man’s feet and
that in the settled areas he often walked in the tracks of the legendary Cobb & Co.

The necessity for better transport and communication became clear as the north evolved. Roads were required not only to open up the back country but for the transport of beef cattle and for defence.

The Commonwealth government in the early sixties allocated money to the project as a matter of great urgency and GHD was commissioned to
design substantial lengths of three of these 'beef roads' in the far north. These latter roads were the Gulf Development Road stretching from south of Mt Garnet to Normanton in the Gulf of Carpentaria; the Peninsula Development Road from Mareeba north up the centre of Cape York Peninsula towards Laura and Coen; and the Burke Development Road west from Chillagoe across the Peninsula towards Normanton.

The Gulf Road first followed a preliminary line prepared by the Main Roads Department from the Kennedy Highway to Mt Surprise over very rough, undulating basalt country. It is the most recent area of volcanic activity in Australia, so rough and boulder-strewn that 40 miles (64 km) travel in one day was considered to be a reasonable day.

Beyond Mt Surprise and up and over the Newcastle Range the road generally followed the original coach road from Herberton to Georgetown. The country was harsh and friendless but relieved by rivers and waterholes, and the surveyors under senior surveyor Don Michael spent months in virtual isolation. Shifting from camp to camp as the surveys were completed they found the ruins of old Cobb & Co staging camps, old stone fireplaces where the permanent blacksmiths shod the horses, and other remnants of those important stopovers.

During the whole of the survey to Georgetown, apart from the 'big' railway township of Mt Surprise (about fifty people), the surveyors passed close to only one homestead, 'Whitewater Station', and within a few miles of just two others. They were virtually retracing the steps of our early pioneers.

One of the most interesting projects in the late fifties was the survey of a route for a coastal road from Daintree, north of Cairns, through China
Camp to Bloomfield River, south of Cooktown. The road, or rather the absence of it, was called the ‘missing link’. No road had ever been built along this route, which appears on paper to be a logical location for a connection, because of the obvious cost. The distance through this steep mountainous area, rich in goldmining history, from Daintree to Cooktown is only 160 kilometres. The main road, which looped around the natural obstacles, was 320 kilometres long.

The survey of the Daintree to Bloomfield route was carried out by Frank Pyne, Bruce Bettany and other ‘old hands’ of the survey teams under extreme difficulties through rugged jungle country, using packhorses for transport. When the survey was completed GHD took the councillors from both Douglas and Cook Shires on inspection trips from the Bloomfield River and from Daintree. The trips, again made with packhorses, convinced the councillors that the project could not be afforded; the appalling conditions and difficulties influenced them to postpone the project.

Ray Rose had previously located and supervised the construction of a road to connect Cooktown with the Bloomfield River. The road was a godsend to the Aboriginal mission and the sawmill with its handful of workers, and gave access to Cooktown where previously there had been none at all. The settlers had at times used packhorses but generally depended on the weekly boat from Cairns to Cooktown for their supplies. The boat was too large to enter the river mouth so the people of Bloomfield River loaded their supplies from the bigger boat to their own little boat which put out to sea as soon as the vessel from Cairns was sighted.

In later years GHD surveyed and designed for Douglas Shire Council and the Main Roads Department the access road through difficult country north from the Daintree River to Cape Tribulation, to serve areas that had been opened for settlement. This is the road that has now been extended, amid much controversy, through the National Park to Bloomfield River. Perhaps GHD was relieved not to have had the responsibility for this extension to the road.

The presence of this coastal road now may well mean that there will be no action on the Upper Daintree-China Camp-Bloomfield River route in the foreseeable future although this route, which has since been generally followed by the power transmission line to Cooktown, would appear to be favoured by many people.

The roads designed by GHD in North Queensland have played a big part in the development of our far north. The Gulf Development Road to Normanton is part of Route 1, the main highway around Australia. The road trains of cattle and refrigerated cargoes of prawns and fish from the Gulf of Carpentaria now traverse the former route of the old Cobb & Co coaches.

Railways and tramways are normally designed to carry people; that’s one of their prime functions anyway. In Queensland it’s not quite like that. Many railways and tramways don’t carry people at all; they freight nickel ore, coal, cane, what have you, with sometimes only a driver and perhaps an assistant to take the freight to its destination.
The development of Queensland has been to a large extent dependent on the building of railways to the sources of mineral wealth for their transport to the coast. The development doesn’t appear to have stopped, perhaps is even still accelerating as new areas of rich resources are discovered and opened.

One of the ‘impossible’ projects which has been completed by GHD was the Greenvale Railway, designed to carry 2.5 million tonnes of nickel ore per year from Greenvale to Townsville 220 kilometres away. The first part of this job was a challenge in itself. GHD was given only sixteen weeks to prepare a feasibility study which virtually involved a preliminary design of the line.

The report was delivered in time but only through the involvement of all available staff from the Brisbane, Southport and Cairns offices. The report was accepted and GHD was commissioned to follow up with the design, documentation and supervision of construction of the entire line. The first nickel ore trains ran from the Greenvale mine to the refinery at Townsville in 1974. With its 3400 metres of bridges, 1000 metres of tunnelling and the crossing of the rugged escarpment of the Hervey Range, the line ranks as a major achievement in Queensland railway construction and established for GHD a reputation for excellence in the design of railways.

The project manager for the Greenvale Railway was Bob Rivett. He was assisted by a team of engineers including Henry Adcock, in charge of design, and Ray Rose, in charge of construction.

An interesting project was the completion of 47 kilometres of the Clare-Dalbeg Tramway to service the cane farms of Millaroo and Dalbeg along the lower reaches of the Burdekin River in North Queensland. GHD was responsible for both cost and technical control and by working throughout the wet season the project was completed six weeks ahead of schedule and
within budget. The project was under the direction of Henry Adcock, who was supported by Charles Guesdon as project manager, David Wilding as site engineer, Keith McGuffie, Larry Molloy and Chris Carne as soil testers and inspectors.

The tramway was built for the Upper Burdekin Co-operative Association Limited, formed solely to organise the construction. Unlike governments with an inexhaustible supply of taxpayers' money, the Co-operative used economies which were quite refreshing inasmuch as they were successful. It hardly seems believable now, when reading the report, but some of the rails used were milled in 1914 for use on the Nullabor Plain and others over one hundred years ago in 1881, in Sheffield, UK, for use in Victoria.

Tenders were called for various sections of the project, with construction being achieved by seven coordinated contracts. The 47 kilometres of trackwork required 76 000 prestressed sleepers, 32 000 cubic metres of ballast and the construction of two bridges. The line was officially opened by the Premier of Queensland, Sir (then Mr) Joh Bjelke-Petersen, on 27 May 1980.

Throughout the length and breadth of Queensland GHD has been associated with railways and tramways, not only for development and carrying of resource materials and primary produce but for the upgrading and improvement of urban and city railways. Someone influential once dubbed GHD as 'the Railway People of Queensland'.

Milk runs would certainly not be expected to have a place in a book on engineering but North Queensland is so different! For more years than anybody cares to remember, GHD in North Queensland has worked with the Atherton Tablelands Co-operative Dairy Association, generally known as Malanda Milk. GHD has carried out project after project for the Co-op, designing cool rooms and milk depots, upgrading buildings and building new ones in districts as far apart as Cairns and Mt Isa.

The Co-operative prides itself on producing quality milk and cheese. It should be able to do so, for its milk producing areas are the lush and beautiful Atherton Tablelands and the dairy cattle there have been bred for generations to become almost near-perfect milk producers. They say in North Queensland that a man or woman who has not tasted Millaa Millaa cheese has not lived.

Des Whybird, of GHD's Cairns office, worked closely with the Co-operative and with its General Manager, Gordon Hitchcock, in both the upgrading and the expansion of the Co-op's production and storage facilities.

In most Australian cities the great dairy co-ops supply their distributors in allotted geographical areas. In North Queensland they just have to be different; the Atherton Tablelands Co-op (Malanda Milk) packs milk at Malanda and Townsville on the north-eastern coast of Australia and daily the great trucks roll out from Townsville, on many of the roads designed by GHD, to one of the Co-op's customers in Darwin, Top End, 2500 kilometres away. It would have to be the longest milk run in the world!

In the early 1970s GHD realised there were limitations in endeavouring to serve the North Queensland region from its Cairns base. It decided to establish an office in Townsville in 1972, which coincided with the
appointment of the firm to the Greenvale Railway project.

Len Rutledge was appointed as manager of the new office, working under the direction of Bob Goakes. In the initial stages most work came from the Townsville City Council and the various Aboriginal community councils which had been established to manage their own funds and development projects. Housing, roads, water supply and sewerage projects were carried out over the Northern Region.

In 1977 Charles Guesdon was transferred from the Hobart office to become manager of the Townsville office. It was at this time that Henry Adcock became the director responsible for the North Queensland practice. It was also in 1977 that a new branch was established at Mackay under the management of Sam Caltabiano.

Both Townsville and Mackay offices played a role in this development of GHD in North Queensland, both working in conjunction with the Cairns office.

The attitude of the people of North Queensland to town and country planning is very different from that which one could encounter in some other parts of Australia. The sprawling north with its sparsely populated areas, its incredible differences in country (the ‘green’ and the ‘dry’ sides of Cape York), its rainforests and dry grassy plains, makes an ecological wonderland balanced delicately by nature.

GHD works with not one shire but with eight, in planning development decades ahead. All new projects within the shires must be approved as being within the aspirations of the shire fathers and at the same time be satisfactory to both the people and companies involved in them. It is a democratic situation where the people discuss development and may offer suggestions or lodge objections, and in a rather unusual way the people’s views are carefully considered.

Some of the far north is as it was in primeval days. It would be sad to see that heritage destroyed by people whose interest may rest solely on the amount of profit available from a project.

GHD is there to assist in the planning of the north. To speak to its planning staff, one almost has the feeling that they are seeking to protect
their own personal property from damage and exploitation. In a way this may be right because the north does seem to be a personal and treasured possession to everyone who lives there.

I discussed the attitude of GHD with Ursula Kerr, urban and shire development planner for GHD. She was poring over a relief map of Cooktown, one of the many unique towns of Queensland. She pointed to areas of historic interest, to the reserves which must be preserved and to other areas where additional development could take place without disturbing the attraction or importance of this lovely little outpost of our country.

I found softly-spoken Ursula a walking encyclopaedia on the urban development of the north. She placed great importance on the relationship between the shire councillors and GHD. 'It has been,' she explained, 'a long partnership of trust and of working together for the good of the north.'
The ‘Top End’

Out on the wastes of the Never Never —

That’s where the dead men lie!
That’s where the heat waves dance for ever
That’s where the dead men lie!
That’s where the Earth’s loved sons are keeping
Endless Tryst: not the west wind sweeping
Feverish pinions can wake their sleeping —
Out where the dead men lie!

‘Where the Dead Men Lie’
Barcroft Boake (1866-1892)

The ‘Top End’ is one of the last great frontiers of the world; the Darwin Town Council was not even formed until 1 July 1956. To Australians brought up on We of the Never Never and, later, Capricornia, there is something very special about this part of our land.

Geoff Davey shared a romantic view of the Territory and a love of its natural grandeur and vastness, but to this he added a deep inner conviction of the importance of developing the huge reservoir of untapped resources across Northern Australia for the benefit of the country as a whole, and in the part engineering must play in this development.

He was not alone in this conviction and a strong camaraderie existed within a group of postwar leaders in the public and private sectors with similar beliefs, people like Reg Marsh and J.J.W. Grey of Northern Territory Administration (NTA) and Commonwealth Department of Works (CDW), A.J. Keast (Rio Tinto), Syd Christie (Comalco) and Davey. But more than any other single professional, Davey was able and prepared to commit his personal time and overall resources of GHD to assist in this development. Not for personal reward — indeed there was considerable financial risk in these early ventures — but because he believed that the successful development of the north would require committed involvement and sacrifice by each of these key sectors of the community, and because he believed in leading from the front rather than coming along to pick up the crumbs after all the initial risks had been taken.

GHD opened an office at the rear of Chin’s Building in Knukey Street, Darwin, in 1956, under the management of Ron Penhaligon, who had been transferred from Maryborough, Queensland, and who is now engineer to the Albert Shire Council on Queensland’s Gold Coast. After about a year Penhaligon left to enter local government, and was replaced temporarily by John McCann. The local association of GHD with the Territory began in
earnest when Alan Longstaff arrived in 1958. Alan had spent his whole working life with GHD. He began in the Hobart office as a cadet engineer, transferred to Melbourne as a qualified engineer and from there moved to Stawell as resident engineer for works in the western district of Victoria. He was to remain in Darwin for six years.

Unhappily for some the romance of the Territory is fading a little. Mrs Aeneas Gunn’s classic *We of the Never Never* depicted Katherine in 1902 as consisting of ‘the telegraph, the police, the cottage and the pub’. It’s not like that now. Bruce Hammond in the GHD office at Katherine, opened in 1983, reported in 1985 that the population of the town had grown from a handful of ‘bushies’ to around 4000 residents and was projected to increase to 10 000 by 1990. It is called the march of progress but the magic of the days of the Never Never has gone for ever.

There are still, however, some odd features of life for an engineer in the Territory.

In 1973, for example, David McAvoy, a surveyor at the Darwin office, was given an assignment to locate a prospect drill hole on Pelican Island. The island is a sand dune 350 metres long and a variable 50 to 100 metres wide. Having completed the job McAvoy found that he had to wait a week for the return trip to Wyndham on the mainland because the helicopter was only permitted to make weekly visits. More frequent trips might have disturbed the large population of pelicans and green turtles on their island sanctuary!

One of GHD’s first projects was the survey and design of the infrastructure, roads, drainage, water and sewerage for the initial government subdivisions in the Nightcliff area and that project has just continued on and on. Today this little enclave has grown to become the major residential area of the City of Darwin, stretching along the coastline across Rapid Creek and past Casuarina Beach.

In the early years at Darwin GHD started with three clients — The Darwin City Council, under Mayors Richardson and Cooper guided by Town Clerk Butler, for redevelopment of the road and drainage system of central Darwin, Fannie Bay and Parap; Territory Rice Ltd — for the Humpty Doo Rice Project; and NTA/CDW for the Nightcliff subdivisional development and the first Pastoral and Mining Development Roads snaking their way east and west from the Territory’s umbilical cord — ‘The Track’, that 1500 kilometre stretch of bitumen linking Darwin, Katherine, Tennant Creek and Alice Springs.

There are not many parts of the Territory’s vital road system with which GHD has not been involved — always in close cooperation with the engineers of the Commonwealth Department of Works (later Department of Housing and Construction) in the earlier years and the Territory Department of Transport and Works since ‘self-government’.

CDW had the key role of stretching the sparse road development funds (with annual budgets that somehow shrank further during the year) while still providing essential road links over an area larger than New South Wales
and Victoria put together. The skills needed for this daunting task were
provided by a young engineering team recruited from State and Federal road
authorities around Australia. To their normal road engineering background
had to be added the understanding of local indicators of natural road materials
— spinifex for gravel, mulga depressions for binder, and so on, to make the
available funds go the extra mile (literally).

GHD’s field teams in these early days would locate the most suitable
routes, often extending over 200 kilometres from the ‘bitumen’, with the aid
of small scale aerial photos and stereoscope, and after review by CDW, would
proceed with the detailed location and design in advance of construction —
again using whatever natural materials were identified, not forgetting the
most scarce material of them all, water.

In this way mining access roads from Pine Creek to El Sharana and from
Tennant Creek to Warrego (for Peko Mines) were developed and ever-
increasing standards of road progressively provided to Mainoru on the edge
of Arnhem Land, to Roper River, Borrooloola, Willeroo and Victoria River
Downs in the north, and towards Yuendemu and Mt. Doreen, Lake Nash and
along the Hartz Ranges to Plenty River, in the Alice Springs section.

Alan Longstaff and John Ryan together with Lech Powierza and Bryan
Kelly from New Zealand developed GHD’s own league of nations field teams
for the performance of accurate surveys in extremely difficult conditions, with
survey parties led by Tim McKnight (NZ) and Alan Shephard (NSW) while
Bruno Tasic (Yugoslavia), Joe Plambeck (Denmark), Frank Woerle (Germany)
and Fred Boekhoven (Holland) provided the instrument work and bush skills.

The average Australian may not be able to visualise the conditions under
which GHD staff and their families lived. They were often hundreds of
kilometres from the nearest urban centre with a daily radio link (conditions
permitting) to Darwin five days a week.

In the southern parts of the Territory, the refraction from the heat haze
made survey possible only from daylight to midmorning and thereafter the
teams retired to what bearable shelter they could achieve with tree branches
piled thickly on the party tents. More than one thermometer burst in the heat.
The only source of water was of course bores and the water usually contained
several thousand parts per million of salts.

Where possible, Aboriginal chainmen were employed and other Aborigines
from local areas were of great assistance in finding locations and looking for
both water and materials for road building. One of the most respected
members of the survey teams was a Leading-Hand Survey Assistant — one
Willy, a blacktracker who led the engineering reconnaissance of new roads
beyond Mainoru and towards Arnhem Land.

After the wet season had started it was not uncommon to find waterholes
(which a couple of weeks before had been parched claypans) teeming with fish.
It was not uncommon also for the workers to find and be bitten by the sharp
teeth of the Johnstone River crocodiles. These very small freshwater crocodiles
are an ancient phenomenon but their bite was not appreciated.

These roads, including the early access roads, the roads sponsored by
the mining companies, and the later ‘beef roads’ of the 1960s, became essential parts of the transport system and were vital for the development of the Territory.

There were problems at times; Bob Goakes told of the time he and John Keays set out to design the Boorooloola Road. From Cairns they flew west to Mt Isa and from there took a small aircraft to a rough landing strip where, landing in a severe windstorm, the plane was blown clear off the runway and finished up upside down in the bush.

They eventually reached Boorooloola to meet an ex-employee of GHD, Dick Pepper. Dick had forsaken the job of chainman to open a store-cum-liquor shop in the town which included one other building, a prefabricated mobile gaol. Keays and Goakes had the choice of sleeping the night in the open in front of the store or accepting accommodation in the gaol, which was at that time without any miscreants.

The other occupants of the gaol were the police sergeant and his wife and a blacktracker with his wife and children. Keays and Goakes found the accommodation quite acceptable and stayed there a couple of nights.

The only vehicle for hire at the hotel was a broken-down utility truck with a crane mounted in the back; the engineers hired the vehicle so that they could get on with designing the 60 kilometres of proposed road.

On the first day, just 20 kilometres from the hotel, they came upon three people sitting disconsolately beside an overturned truck in various stages of disrepair. The accident had happened two days previously, when the truck had been returning to a mines exploration camp loaded with beer to help the thirsty miners make the long journey back to their base at Mt Isa. One of the three had a broken wrist and the other two were cut and bruised. With an overturned truck they just had to wait for some travellers to help them push the truck upright, which Goakes and Keays did.

The three victims, recalled Goakes, seemed to be more worried by the hostile reception they expected to receive when they broke the news to their miner friends that much of the precious beer had been lost in a welter of broken bottles!

Breakdowns were quite common in that area and Goakes and Keays themselves were victims of one later and had to sit down by the road for some hours before being rescued by the police sergeant who came searching for them after they were some five hours overdue.

Goakes was also involved in the design of the Mataranka-Roper River Beef Road. It was largely monotonous, flat country with little shade from the few trees. He later had vivid memories of heat so pitiless that often his little group had to take shelter under their truck to obtain some respite.

Mataranka at the time was renowned for its stockpile of empty beer bottles. As drinkers emptied their bottles they simply threw them over the fence at the rear of the hotel on to a pile which was, by the seventies, 4.5 metres high!

The wet season from late October/early November until a couple of months after the new year meant that no work could be done in ‘the wet’
and all the working teams had to be pulled out.

In 1953 the Menzies government was requested by the United Kingdom to introduce a major rice-growing scheme to offset the problems which could follow the taking over by communist governments of the rice bowls of Asia. The British government was concerned that people living in many of its colonies were dependent on supplies of rice as their staple diet, and they believed that the control of rice supplies by the communists would create an intolerable situation.

The Australian government examined the proposal and eventually approved a submission put forward in 1954 by six wealthy Americans. An agreement with the syndicate was signed by the government in 1955. It was politically a very sensitive area — the giving of a monopoly to non-Australians who knew nothing of rice growing whereas leases had been withheld from Territorians because of their lack of experience!

The first decision was to proceed with a 5000 acre development and GHD was engaged to survey the irrigation area, design an irrigation system utilising local materials (involving wartime disposals wherever practical), and to provide, in conjunction with Northern Territory Electricity Supply, the power needed for the irrigation and drainage system pumps. There was very little time available to complete the initial development before the next ‘wet’ was due.

The first key to this rapid programme was Tom Meaney’s survey parties who had the job of rapidly locating and marking the maze of supply and drainage channels and the many miles of three inch contours behind which Thiess crawlers formed the check banks for the rice bays across these flat plains.

Then the unique pumping systems were manufactured, largely from wartime disposal materials. Designed by John McCann and his Sydney office team these included a special floating 100 cusec main pump across the main supply-drainage channel at the Adelaide River which could both supply fresh water into the system and drain water off the land at the end of the growing season. Control of the buoyancy chambers enabled this station to float itself up above floodwaters during the wet. Secondary supply from the main channel was provided by 50 cusec boat-pumps able to be moved progressively to power stations along the channel. When their impellers proved unstable, and with replacements thousands of miles to the south, a suitable alternative was found amongst Darwin disposals in the form of a ship’s propeller of suitable axial-flow pitch which enabled the pumps to lift over 10 000 gallons per minute onto the rice paddies!

And finally a power supply from Darwin to the Adelaide River substation set high in the air against floodwaters with a wishbone crosshead which Davey believed necessary to prevent geese platoons from short-circuiting across adjacent phases.
There were problems with supplying the necessary fresh water in those early days, but rice was grown, harvested with half-tracks, and transported to a rice mill constructed at the 22 mile mark on the Stuart Highway. The survey proceeded on an enlarged 10,000 acre area, a huge developmental project.

It looks so simple to see the paddy fields of Asia produce rice in abundance. It has probably taken 1000 years of trial and error for the rice growers there to perfect their planting, the selection of the particular strain of rice and the areas for rice growing, the paddies. These simple factors, the basis of good rice growing, were ignored particularly in the study of available water. The Asians know their rivers and their water supply.

In theory, as soon as the first spots of rain appeared the paddy would be saturated with water and the rice planted; water would then be pumped into the paddy as required. In practice the water in the river was so low that its resultant high salinity made it unfit to use. The rice could not be planted without water anyway, particularly as prior to the rains the paddy was set like concrete.

Rice has a critical time basis for its growth. It must be planted and established as soon as it rains so that the head of the rice is always above the water.

The first planting was made after the first rain appeared but the rain stopped and the rice died. When a little more rain came it was resolved to plant from the air to save precious time and that’s when the local geese, whose nesting habitat had been that flat country for 20,000 years, decided they had never had it so good. They enjoyed and grew fat on the seed rice.

Newspapers blew the geese story right out of proportion; it was a problem but was not unique — the sulphur-crested cockatoo and the galah have raided wheat-growing areas since wheat and grain were first sown in Australia. However, in a project which was hopelessly short of adequate funding, an official birdwatcher and birdwatcher’s assistant were put on the payroll to keep the geese off the project; they didn’t!

One of the first bad decisions was in selecting one single variety of rice for planting. Any peasant in Asia is aware that a full head of rice must be quickly harvested before it deteriorates from exposure to the sun. This problem of harvesting is simple to solve in Asia where harvesting is done by labour-intensive methods.

The expensive harvesters with huge rubber tyres which had been purchased for the harvesting simply could not do their job in the mud. They had not been tried in these conditions!

The mistakes which were made are almost unbelievable from this distance but many of them could have been solved. McCann’s pump worked satisfactorily in drawing water from the river. Given the money to pay for it, water storage areas could have been built and the CSIRO could have produced different strains of rice to germinate at different times.

The cessation of financial support from the government before remedial measures could be introduced was the major factor in its final failure.
Mining has played an important part in the development of many States and the Territory is no exception. The first development of much of this country has always been the work of the miners.

Mining development needs engineers — for access roads and rail, for water systems and power, and ports and processes and new towns, so GHD becomes involved.

Although mining in the Territory dates back to the Pine Creek diggings of the last century most projects really commenced in the 1950s — Peko at Tennant Creek, the Moline and El Sharana mines east of Pine Creek towards the South Alligator, and the bauxite deposits of Yirrkala-Gove on the northeast tip of Arnhem Land. GHD has been involved, in one way or other, with all of these.

The abundant red bauxite gravels of Gove had first been noted when an airstrip was built on the plateau of Gove peninsula above the Yirrkala Mission during World War II, and a Catalina base established on the beautiful natural harbour of Melville Bay.

When British Aluminium first proposed the detailed study of the mining of the bauxite in the late 1950s Geoff Davey was able to bring to the project the experience of access roads, ports, major water storage and town infrastructure gained in earlier years.

With no roads within hundreds of miles of Gove it was necessary to ship in the landrovers, tents and utensils necessary for the investigating engineering and survey staff and to transfer a bulldozer needed for sampling the ore deposits. A trade was arranged to ship the dozer on the Catholic Mission lugger ‘Margaret Mary’ and Longstaff still has occasional nightmares in which the dozer, hanging precariously thirty feet above the lugger moored at Darwin wharf, starts to plummet from the World War II vintage crane onto the unsuspecting lugger below.

Arrangements to transport the landrovers were finally completed via an oil exploration landing craft returning from the Timor Sea. Four days later a radio message arrived from Yirrkala advising that two of the three landrovers had been written off. With scarcely another vehicle within hundreds of miles they had met head-on on an RAAF road overgrown since the end of the war.

By cannibalising parts two landrovers were finally rendered functional and with kind assistance from the Mission from time to time the team was able to proceed. The dozer around which most concern had centred arrived unscathed!

The party, led by Bryan Kelly, set up a base camp in a disused open-air RAAF barracks near the landing strip. The only problem this site presented was during the traditional Aboriginal burn-off towards the end of ‘the dry’ when sleep was continuously interrupted by exploding ammunition.
Difficulties in cutting tracks through thick vines and heavy tropical vegetation off the plateau were offset by the benefits accruing during the hydrographic survey which included an abundance of oysters and plenty of tuna and barramundi.

With British Aluminium support, plans for mine roads and a long distance conveyor belt from the plateau to the proposed Stage II alumina plant and harbour facilities were laid out, water storage located and bores investigated, and a township and services surveyed.

For the first stage of development, British Aluminium believed the alumina plant should be deferred and the raw bauxite treated at Gladstone. The Commonwealth refused to agree and the lease was then progressively transferred until finally Nabalco accepted this leasing condition. The alumina plant was then developed, port and ore loading facilities completed and the beautifully landscaped residential town of Nhulunbuy developed in a most attractive setting.

Since the completion of the mine and town by Nabalco, GHD has carried out a range of work at Gove. Ivan Luscombe, senior surveyor in Darwin, and his successor, John Matthews, and their staff carried out many surveys and later handled all the surveying required by Nabalco. GHD Darwin office attended to the engineering of expansions of the town of Nhulunbuy which accommodated the Gove workforce.

Through the early 1980s GHD had a most interesting task in this area. The concrete floor slabs over large areas of the alumina plant were heaving upwards, with serious effects on drainage and reclamation of the caustic liquor used in the process. Initial investigations into the cause and possible remedies for the problem were carried out in the Sydney office under the direction of Roger Smith, with the assistance of Professors Ingles and Loughnan of Unisearch Limited.

Jim Callum, who was then manager of the Southport office, took over the further field investigations and remedial work. The heaving proved to be caused by expansion of the clay, typically associated with bauxite deposits, following a reaction with caustic liquor percolating through the concrete floor. Procedures were developed on site by Callum and the GHD engineers stationed at Gove, in collaboration with Nabalco staff and the contractors, to remove the failed slabs, pump out the caustic liquor and progressively dilute it with fresh water, and replace the slabs with improved drainage and sealing to obviate the problem in the future. Ron Eaborn from Melbourne office was the GHD site engineer for some years while this major remedial work was carried out and liked the place so much he stayed on as part of the engineering workforce.

Some significant contributions which GHD has made to the development of the north include that of improving living standards for the local Aborigines.

It is now quite fashionable to assist the Aborigines, but GHD has been
working with them for a long time. One area of importance to GHD staff has
been housing for Aborigines and by May 1974 the company had already
boosted its staff at Darwin to service this new area. It was a new and exciting
project to prepare suitable fixed accommodation for people who had only a
few years before been totally nomadic and who still chafed at the normal
concept of a house which shut out the beautiful sky, the cooling breezes and
a sense of freedom.

Aboriginal settlements in the Territory were permitted to apply for
government funds to erect houses and at one stage GHD was working with
fourteen such associations. The projects provided a unique challenge, not only
because of the remoteness of the areas where construction was taking place
but also because of the nature of the Aborigines themselves, many of whom
found it difficult to relate to modern housing situations. Acting as technical
advisers, Darwin staff of GHD visited the various outback settlements and
discussed with the local people the type of houses they wanted.

The projects could not be confined or limited to the mere design of
housing. There were allied problems, sometimes quite difficult to overcome.
These included the purchase, assembly, storage and transport of equipment
and materials. In addition, there were the difficulties encountered by the
project managers and tradesmen working in isolated conditions.

The design of water supplies, sewerage systems and electric power
generation and distribution was of course most important in those remote
communities that lacked some or all of these amenities. GHD was engaged
by the government or by the local association or council to carry out this
work in many villages. A typical project was the sewerage system for the
township of Ngukurr on the Roper River, which had a population of some
500 people. In this case, GHD designed the complete scheme, including sewage
ponds as the simple but effective method of treatment, and then supervised
the construction of the whole project, which was largely carried out by the
local people, on the site.

GHD staff frequently found themselves heavily involved with Aboriginal
associations on problems quite separate from the professional work they had
been commissioned to perform. They found themselves assisting the elders
of the associations by preparing their applications for funds and in the
selection and appointment of managers and so on.

All this work on Aboriginal housing and associated works was carried
out under unusual political circumstances. The Federal Labour Government
of the mid-1970s was determined to accelerate to a marked degree the process
which had been commenced, somewhat tentatively, by the previous Liberal
Government. This acceleration was no doubt warranted in some ways, but
the generous allocation of funds to Aboriginal communities sometimes
preceded the setting-up of necessary arrangements for handling the money,
determining requirements, preparing designs, arranging for the mobilisation
and training of people from the local community and organising the purchase
and despatch to remote areas of the necessary materials. There had not been
time in Canberra for the appropriate systems to be developed and put into
place. This on occasions led to unusual situations, and it appeared that sometimes the money was literally provided ahead of other actions.

The honest simplicity of the people with whom they were dealing was quite touching. Roger Winton, of the Darwin office of GHD, was taken aback one day when the fine old chairman of an Aboriginal association thanked him for his preliminary explanation of the proposed project then presented him with a cheque for $457 000 which he had received from Canberra to cover the estimated cost of the project!

Roger was unable to persuade the old gentleman that it was not his (Roger’s) job to accept government cheques in this way, particularly as the actual building of the project had not even commenced at that time. The chairman was adamant that Roger must accept the cheque so he did so in deference to the old man’s self respect. After a series of enquiries in Darwin, Roger was eventually able to lodge the cheque with the association’s accountants who promptly banked it. One wonders whether other such cheques, so freely handed out at that time, ever went ‘astray’, but at least in these instances it certainly appears that ‘red tape’ was not involved.

GHD was adviser to the Northern Territory Building Administration and designed and developed suburban areas in Darwin, Katherine, Tennant Creek and Alice Springs. These projects were designed specifically to meet the site requirements and the conditions of the Northern Territory.

At Alice Springs GHD had previously designed an industrial site, a sewage treatment works and the West Side Open Drain in the city, and in the 1960s was asked to do a rush job on a housing project. The reason for the urgency was the imminent arrival of hundreds of employees and their families from other parts of Australia and from the United States to build and man the Pine Gap Tracking Station.

The town planning and survey work for this new subdivision of Gillen had previously been done but, with a permitted time span of only six weeks, almost the entire GHD staff of Darwin and Brisbane produced designs for the complete subdivision including roads, drainage, sewerage, bridges over the West Side Drain and a new drain, the Gillen Creek Drain.

Although residents of tropical Australia are not unused to cyclones, Cyclone Tracy was such a force that memories of previous cyclones faded by comparison.

Tracy was a ‘small’ cyclone but was exceptionally intense. It passed slowly and directly over the City of Darwin in the early hours of 25 December 1974 and by the time it had subsided the city had been virtually destroyed.

Between fifty and sixty percent of its 11 000 houses and apartments were damaged beyond any hope of repair; hundreds of houses were simply blown
away, leaving bare ground covered with the debris. All essential services were disrupted and although the bodies of the dead could be and were collected and buried, the plight of the injured was very bad.

GHD had a staff of fifty-five in Darwin at the end of 1974, the largest number in the office at that time. The premises in Beagle House had filled and overflowed to the City Mutual Building a couple of blocks away. In addition to an extensive programme of works in the usual civil engineering and survey practices, activity was at its height in the field of Aboriginal housing, with architects, draftsmen, works supervisors and materials expeditors augmenting the staff numbers of previous years.

The firm owned six houses in Darwin which were occupied by senior staff members. Two of the older houses, originals from Davey’s time, disappeared with all their contents. The three houses on high blocks were virtually demolished above floor level, while the remaining house, brick on a concrete slab, occupied by the Luscombe family, remained reasonably habitable. Insurance claims in full were made and were met on five houses, with a substantial payment for damage on the sixth house. Norm Traves and Robert Lloyd had resolved to obtain revaluations on all houses a month or two earlier and the insured amounts had been increased substantially!

Coincidentally, D.J. Dwyer & Associates, consulting engineers, who were to merge with GHD later in 1979, were also working in Darwin prior to the cyclone, under the management of Harold McKenzie.

Some of the stories which came out of Darwin brought the picture vividly to life.

Mrs McKenzie wrote to her family in England of her thoughts during the cyclone. Extracts of her letter were included in the 1st Annual Report of the Darwin Reconstruction Commission 1975. Her letter clearly illustrates the problems which GHD and all other consulting engineers would have encountered in the task of rebuilding a city from the ground up. For example, before anything in the nature of rebuilding could commence, the debris of a destroyed city had to be removed. Again, an entirely new approach to housing design had to be made to avoid a similar tragedy in the case of another cyclone. Here are some extracts from her letter:

‘It was eleven o’clock on Christmas Eve and we lay on the bed fully dressed listening to the wind. We are used to violent storms in Darwin and Cyclone Selma had come frighteningly close to us three weeks ago but had veered off. We were used to the nasty-sounding klaxon on radio and knew all the precautionary instructions off by heart and had carried them out. ‘If the house shows signs of breaking up, shelter in the bathroom or under the bed.’ It was impossible to imagine this, especially in an elevated house, and the thought of not being on the ground was not a pleasant one.

The wind gusts became worse than we had ever known them before.
'Tracy is expected to hit the coast at 2 a.m., with very destructive winds and phenomenal seas.' We had never heard that phrase before. If the wind is this strength now, how can it possibly get any worse? We had a lot to learn.

There was a horrible high-pitched sucking noise all round the house from the wind pressure against the windows and the noise of loose debris being bowled along the road. More uncanny and frightening than that was a sudden bursting sound from the other end of the house and then everything seemed to happen at once. The radio went off, the lights went out, the wind became unbelievably stronger and there was rain, thunder and lightning.

We went into the spare bedroom where there were the least windows and loose furniture and just stood wondering what to do next. Above the noise of the storm, flying debris and breaking trees, came a great rending noise of cracking wood, creaking and straining, and the whole place was shaking. As we got under the bed there was one great heave — suddenly we could see the sky and feel the rain. Our roof was gone! We dived under the bed and lay on our tummies, not knowing what would happen now. Another big gust and heave and the foot end legs gradually sank down into the floorboards. By this time we were lying in water. I tried to crawl out on my side but came up against something solid and immovable — the wardrobe had tipped over on to the bed. It was impossible to lift the bed with our backs, but Harold managed to squeeze out on his side, told me to stay put, and disappeared. It was horrific to be left lying on my tummy in the cold water, darkness and noise all by myself. This was my most panicky moment. The restriction and feeling of being trapped all added to the general feeling of helplessness. After what seemed an age Harold came back and said to crawl out carefully without looking out or down, to climb back over the bed and follow him.

I remember there being no bedroom left except one wall and I still have a dim recollection of looking out on to nothing except the house next door, half gone and their outside stairs broken in two and flapping in the wind.

We went then into the narrow passage that leads to the bathroom and study.

The two walls of the passage began to fall together like a pack of cards. I looked up and could see them waving above my head and I wondered why we had not been hit by anything falling from the sky, ... even bits of glass. I found I had one foot in the kitchen vegetable rack and wondered how it got there. Then a packet of Omo descended and the rain on us tasted soapy instead of salty and our fingers were slimy! Then came the very worst. The thunder and lightning were continuous. The thunder was a distant rumble, blanketed by the wind noise which was a cross between a screech and a roar. On top of that was the creaking of breaking timber and the straining of joints. Over
all was the din of flying tin as it wrapped itself around bending electric poles and spiked itself on railings. Everything shook, and so did we, from cold and fright.

We tried to keep those two walls from falling together, with us in between, by standing with our bottoms against one and our hands against the other. A hopeless thing to do, but it may at the time have helped to keep our thoughts off other things. So there we were, with our backs literally to the wall, heads down against the lashing rain, hanging on for our lives. I hoped the walls would fall quickly and hit us hard so we would not know anything. Being elevated to first floor level my mind blanked at what would happen when everything collapsed and us with it...

With the dawn came the full impact of what Tracy had done. As far as we could see was complete devastation.

We clambered over the rubble on the floor of what had been our house, but could not get down the front stairs. They were split in two and going off into space. Over the debris again, and I remember seeing the fridge on its side and wondering what had happened to the turkey! I picked up an unbroken flagon of sherry on the way to the back stairs, which were intact. I was excited by that! And saddened at seeing our once prolific jasmine down to two bare sticks and the arch it grew so thickly over was not there at all. The electricity poles were still in their foundations but bent to a right angle.

The car was there under the house but invisible under sheets of tin. It was now seven o’clock on Christmas morning and full daylight — a full hour later than usual. A Happy Christmas to us both!

Alan Thompson, a senior engineer with GHD at the time, wrote of similar experiences as did many others of that dreadful night in which the city was destroyed.

The bulk of the population of Darwin, including nearly all the women and children, were evacuated from the city during the week following the cyclone.

For the staff who remained in Darwin, the first priority was to establish some shelter in which to live, and the next, for people still in town, to clean up the offices and gradually set about re-establishing normal operations.

Norm Traves, who was by then the GHD director responsible for Darwin, asked Roger Winton, the senior staff member remaining, to stay on for the immediate future and organise the affairs of GHD as far as possible. Roger patched up some of the roof of the GHD house in which he lived and stayed there with his family. There were two offices at the time and both were in a mess, though both buildings were intact except for the missing windows and some roofing. Several GHD families camped in these offices until evacuated.
Ivan Luscombe, chief surveyor, whose GHD house was least damaged, did a great job in salvaging office and survey equipment and the remaining possessions of staff who had been away on leave (including manager Robert Lloyd) or had been evacuated.

It was established fairly quickly that there were no serious injuries among the staff and families, but many narrow escapes. After a few days eleven staff members of the pre-cyclone fifty-five were more or less available for duty. Mrs Billie West and others did a great job in cleaning up the offices and salvaging plans and papers.

Traves reached Darwin shortly after New Year (permits and air tickets were difficult) and camped with Luscombe. Operations were gradually being re-established. There were many jobs on hand for clients outside Darwin, who still wanted to see progress. The whole staff and remaining families totalling seventeen people gathered one night for a barbecue at Roger Winton’s ‘house’ and feasted on an enormous barramundi sent to Darwin by Fred Langton, works supervisor for GHD down at Roper River, and cooked on an open fire in the backyard. Half of the fish was still left after the barbecue.

The effect of Cyclone Tracy on Lech Powierza’s house.

With most of the work done by staff as volunteers in the clean-up process now completed, people like Lech Powierza had to set about rebuilding their own houses and, for some of them, this meant considerable expense and years of work at weekends, at night and during their ‘holidays’.
Gradually staff were enticed back from the south, generally without their families. Accommodation was the problem but two demountables and several caravans were established, while other staff lived on the ship moored in the harbour for the purpose or in the firm's houses repaired in makeshift fashion.

Kerry Hampson and Ralph Hawkes from Cairns moved to Darwin to assist. Harold McKenzie, who was manager of Dwyer's office, and Alan Thompson returned from their evacuations, and Robert Lloyd from his overseas leave.

There was a great deal of work to be done in the rebuilding of the new Darwin, apart from the normal work to be carried out by both the GHD and Dwyer offices. Relationships had to be re-established with clients and work had to be recommenced, after that spectacular 'Christmas break', on the many remote projects of GHD. Accounts and correspondence had to be attended to, and many enquiries relating to the rebuilding of houses were being received — a type of work that was to be important for some years.

The stories from Darwin were all similar in general heartbreaking, but some letters revealed losses of which an outsider would not necessarily be aware — the destruction of office equipment and records. Harold McKenzie, who returned to Darwin on 13 January, wrote:

'Don Dwyer and I arrived in Darwin at midday to reform the recently formed D.J. Dwyer & Associates (NT) Pty Ltd. By late afternoon we had committed ourselves to taking up remodelled office space in the old Schombacker Building (Don's first office in Darwin). This old building of only two floors had suffered some damage, the roof leaked in some parts and in others the rain just poured in. It was our task to pick the driest office and this consisted of approximately 650 square feet (60.4 square metres) with one window blown out, no power, three roof leaks, no telephone and no air-conditioning.

Mid-Tuesday a.m. Don Dwyer, Peter Salthouse, Otto Thomas and I started the mammoth task of cleaning up the wreck of No. 57, checking what was worth salvaging, loading it into the two vehicles and then carting it upstairs to our new office.

By Wednesday afternoon, Don MacMaster had also been able to throw in some muscle during the day, we had almost made the transfer, i.e. we had shifted everything essential for the initial set up — but then we had to start the task of cleaning, sorting etc. If anybody has ever seen what happens when an old building containing an old gyprock ceiling is devastated by a cyclone and days of tropical rain, you can perhaps realise part of our task. Every item of furniture we had salvaged had to be wiped down thoroughly, sprayed with anti-rust preventative, books and files sorted for mould and fungus which was growing everywhere. Most of our catalogues had to be discarded and drawing instruments were going rusty. A $16 000 computer (only 24 hours old on Christmas Eve), a useful machine, had to be discarded. Then followed an electric typewriter, several calculators and so the sorting and cleaning went on for approximately another seven days.
Our morale was lifted a little on Thursday 16th. My two engineers, John North and Peter Easther, who were both out of Darwin for Christmas, had responded to our call to return to Darwin. We needed their help very much.

Accommodation was critical. Don and I squatted in a flat for three nights, then to fit in Peter and John we had to swap around into a flat that was still intact under the remains of my house. Don returned to Sydney on Friday — I think he was glad to be getting on the plane. I had hoped to return with him the same day, but there was too much to be done. His departure did nothing to relieve the accommodation problem.

Peter Easther and his wife Ann, John North and Brian Read were still squatting in the flat that Don and I had occupied a few weeks ago. Peter Salthouse had managed to talk himself into a Housing Commission flat, Don MacMaster had managed to get a roof back on his own house in Stuart Park — but no power and little in the way of the joys of life.

Only one job had come into our office since the cyclone — to design and detail, with some urgency, a caravan park for approximately 100 caravans. Fortunately, a similar job had been in our office (and Brisbane's) before Christmas in a different format and we were able to pick up the new work very quickly.’ (The plan for the caravan park so urgently required by the authorities was scrapped completely on 5 March 1975 whilst the government rethought the whole of the programme for reconstruction).

The rebuilding of the city was not a simple matter. At the time of Cyclone Tracy a considerable portion of the housing in Darwin was owned by the Commonwealth government and rented to public servants. Also, there were many houses and flats owned by its housing authority which were rented or in the process of being purchased. So the government was faced with the problem of reconstructing these destroyed homes.

One of the problems for the government was to decide whether it was to concentrate solely on the re-establishment of government property or whether it was supposed also to provide assistance to the private sector.

Again, with virtually no shelter left in the city, the government purchased caravans and demountable-type units and made them available to both public servants and private people on a needs basis.

The eventual contract for the design and erection of housing was the largest ever let by the Commonwealth government for housing, $55 million. Robert Lloyd was seconded by GHD to the Reconstruction Commission for six months and played a leading role in the provision of the new houses. Some 5000 government-owned or controlled dwelling units needed repair or replacement in addition to homes owned privately.

It was a contract which had included many problems. Camps almost of a permanent nature had to be set up for tradesmen and labourers with full amenities, water, sewerage, lighting and roads. Supplies had to be available for them and catering facilities had to be provided.
The Reconstruction Commission decided that as the city was virtually without houses it was an excellent time to redesign the layout of the suburbs. While the sentiment was excellent the unfortunate residents were not prepared to be advised that the shifting of their cottages to different locations was all that they wanted.

One of the interesting aspects of the Reconstruction Commission was the establishment of area agents. The total area of Darwin was divided into four and different consulting firms were appointed to look after these areas. Both GHD and D.J. Dwyer & Associates were awarded areas, with Alan Thompson and Harold McKenzie as managers. The idea was that the firms would coordinate all the activities in their area and be a point of contact for the people in the area. The scheme operated from about March to October in the year following the cyclone and fulfilled a great need in getting reconstruction work underway.

The rebuilding of houses was, at this time, the most important aspect of many people’s lives but the authorities appeared to be very slow in getting moving. The general influx of Canberra-based public servants that occurred in early January seemed to bring a greater emphasis on planning for a model city than for catering for the needs of the population.

Guidelines for house building eventually were produced and, in general, all plans required close scrutiny by the Building Board and certification by a structural engineer. For a few months the structural side of the practice concentrated on house design details.

The stories which have come out of Darwin following Cyclone Tracy are legion. Mrs McKenzie’s letter of the actual cyclone is one of many telling of the terror of that night. The impressions of others who worked hard to rebuild the shattered town were quite moving also. As Robert Lloyd wrote some years after the tragedy:

‘For those people who had friends or relations killed in the cyclone then this naturally remains the dominant feature.

For those returning afterwards the memory that remains uppermost is the immediate mess. So widespread was the mess that it was hard to comprehend whether it would be possible to clean it up.

Then you realised there were no leaves on the trees and a lot less trees and you could see for a long way.

Perhaps the most moving experience was walking at night along the roads past all the wrecked houses. It was the silence that was most noticeable. No power, so no fans or refrigerators or air-conditioners or radios or television that all make a background noise that is not really noticeable until it isn’t there. The silence and the darkness, no lights except for the quite eerie flicker of a candle or a hurricane lamp amongst the wreckage; it created a strange feeling — people are actually living amongst that incredible mess. Silent night.

Years later, with the reconstruction complete and Darwin expanding with great enthusiasm, it can be said that, leaving out the personal distress, the city is a much better place to live in now than it was before
the cyclone. The fibro wall, tin roof sameness has gone and has been replaced with the sturdier structures of great variety. And not only are the trees back, so are the birds.’

GHD participated in the design of that new Darwin and is justifiably proud of its record in the reconstruction of our northern capital city.

Darwin expanded rapidly after Cyclone Tracy with consequent traffic problems. In May 1979 the Department of Transport and Works of the Northern Territory commissioned GHD to design the Bagot Road Flyover. It was opened in December 1981, a month ahead of schedule and within budget.

Darwin’s layout (the city centre is situated on a peninsula) had previously caused congestion with long queues in peak hours when people travelled to and from work each day. It was considered that a flyover could solve the traffic problem but it was a restricted site and the bridge had to be curved horizontally and vertically and to be super-elevated.

The construction required many ‘firsts’ to be used in the north. Reinforced earth had not been used in the Territory before. Quality exposed aggregate finish of the reinforced earth panels provided an aesthetically pleasing appearance to the ramp walls and the ease of construction provided a practical solution in a confined area. The use of Illinois crash barriers, segmental box construction and staged stressing were also ‘firsts’ in the Northern Territory.

The project team consisted of Robert Lloyd (responsible principal), John
Fisher (design engineer — superstructure), Russell Hoskin (design and project engineer), John Gersekowski (design), John Burton (senior resident engineer) and Colin Horne (inspector).

The contractor was Steelcon Constructions Pty Ltd of Darwin, while Jeffrey and Katauskas Pty Ltd provided geotechnical advice as secondary consultants.

The Bagot Road Flyover received the Association of Consulting Engineers Australia Engineering Award for the project of outstanding merit in the category of civil engineering but, perhaps more importantly to the people of Darwin, it solved a problem.

Another town which is catering for the tourist trade in the north is Yulara, an Aboriginal word meaning 'howling dingo'. It has become almost synonymous with Ayers Rock as a result of a tragedy there which caused a nationwide controversy over a period of some years.

Visitors to Ayers Rock, the largest monolith in the world, have increased in numbers so much that Yulara, a new village, has been built to accommodate them. The facilities, which will no doubt be further increased, were in 1984 providing for 6000 visitors per day!

In October 1969 GHD Darwin was commissioned by the Northern Territory Electricity Commission to prepare a design report on power generation and distribution for the entire complex, including a feasibility report into a total energy scheme and subsequently for the detailed design and supervision.

Climatic conditions in the vicinity of the Rock include harsh temperatures which range from below zero to 50°C and the area is in a sandstorm zone with limited water supply. The site has no nearby engineering support facilities and radio communication is provided only by the Royal Flying Doctor Service at Alice Springs.

The station comprises four 650 KW diesel generating sets with provision for a fifth set. Medium speed 750 RPM four-stroke diesel units of the dual fuel type (diesel fuel and natural gas) were selected, and each was equipped with water heat recovery from jacket water and exhaust gases to produce hot water for winter heating and for summer cooling through absorption-type air-conditioning equipment.

So as to be environmentally non-intrusive the plant control building, which also houses offices, stores and workshops, was designed as a one-storey structure and finished in natural colours. Its location in a depression between sand hills, away from the village, provides for a future solar power station to be constructed.

Bulk fuel and oil storage tanks are buried underground. Waste products have been reduced to a minimum; even used engine oil is cleaned by centrifuging and either reused in the engines or blended with the fuel, depending on its 'cleansed' quality.
Sid Brischetto of GHD Townsville was project manager, Robert Vincent the on-site supervisor and John Kenworthy was responsible for the civil and structural aspects. Cleland Robinson Pty Ltd and the Department of Transport and Works, Northern Territory, provided architectural services.

A pleasant aftermath of the construction were two references to its engineering excellence. The power station received a Special Mention from the Institution of Engineers Australia, Northern Territory Division, at the Institution's annual awards ceremony held in Darwin in June 1983. The second award was a 'Highly Commended' certificate in the Mechanical/Electrical Engineering category presented at the ACEA Conference held in Mildura in October 1983. The mechanical and electrical engineering had been under the control of Joe Iriondo of the Darwin office. The judges awarded the commendation 'in recognition of the manner in which GHD handled the difficult constraints of operation, water and climate in a remote and sensitive environment'. Ben Fink, Managing Director of the GHD Group, accepted the award on behalf of the project team.

The reader may be pardoned for thinking that the practice of GHD in the Northern Territory has been full of excitement, spectacular projects, unusual hardships and noteworthy events.

It has covered all these things, but in the thirty years over which GHD has practised in the Territory, a great deal has been achieved in more commonplace fields of engineering and surveying. These aspects of the practice have really been an extension into a new environment of the traditional fields covered by GHD in the south.

From its earliest days in Darwin, GHD has been referred to by the government departments — initially Commonwealth but later Territory — concerned with water supply and sewerage as their 'hydraulic engineering consultants'. This resulted from the expertise in the water engineering field that successive managers of the Darwin office — Longstaff, Ryan, Bruce and Lloyd — took from southern offices to Darwin. With fairly small but capable staffs, and support from the south when necessary, GHD has designed the major portions of the Darwin sewerage system in the older parts of the city and the more recent northern residential suburbs and the new satellite town of Palmerston. This work included sewerage systems, pumping stations and treatment plants, mainly the cost-effective lagoons which have been shown to operate well in this tropical area.

Some of the actual construction work in the early years, mainly by itinerant labour forces, was not carried out to a particularly high standard, and with the spread of the suburbs and more intensive development of the city area, some of the system is now in need of maintenance and augmentation. Again, GHD is involved in much of this remedial work, employing modern techniques to analyse the system and the effects of infiltration of rainwater so that the most effective and economic measures can be taken to rehabilitate the system.

Sewerage work has not been confined to the larger centres such as Darwin, Alice Springs and Katherine, but has extended to far-flung Aboriginal
communities like Ngukurr and Oenpelli, to name but two.

Water supply too has been a major field of practice, covering pumping stations, reservoirs, pipelines and treatment plants in the cities and towns and the small outback communities.

Land development for suburban expansion has always been a major activity for GHD in the Territory, from the earliest days in Nightcliff, as Darwin, Alice Springs and Katherine in particular grew rapidly in population. Over recent years this work has continued in the large new suburban developments in Leanyer in Darwin and Larapinta in Alice Springs. Much work was done by the Dwyer organisation before the merger with GHD.

Alongside these works there was the usual GHD variety of commissions covering almost all aspects of engineering — dams, buildings, all manner of recreational facilities, structural and mechanical and electrical services for the Darwin Casino, drainage and the rest, and investigations and studies covering many aspects of the future development of the Territory.

In addition to these engineering activities GHD has since the earliest days conducted a major survey practice throughout the Territory, handling from Darwin initially, and more recently from Katherine and Alice Springs, engineering and cadastral surveys for every type of development. These have ranged from surveys for roads, pastoral property boundaries and mining leases in the most remote areas to precision surveys in the cities and for major buildings. They have even included extensive surveys for the much-discussed Darwin to Alice Springs railway which still shows no signs of becoming a reality.

The Northern Territory covers a large area — it is some 1500 kilometres from Darwin to Alice Springs. For this reason, GHD has found it appropriate to extend its activities in the Territory as it has done in the southern States. A branch office was established initially in Katherine in 1983. Then in 1985 Bert Saunders, who had been with the Dwyer organisation before the merger, transferred to Alice Springs and opened the office in that city. Alice Springs is growing rapidly, mainly because of the tourist industry, and this office has never looked back. The usual variety of work has been undertaken — major suburban land development, city buildings, sewerage, jobs for remote Aboriginal communities, planning and surveying. John Baird moved from the Gold Coast — quite a change of scenery — to assist Saunders and the office is well established.

The strength of GHD in southern States has been of considerable value to the Darwin office, and indeed to the Territory, over the years.

Most of the staff members, particularly senior staff, who have worked in Darwin have been transferred there from southern offices, in many cases to remain in Darwin of their own choice, for long periods. In more recent years, as the general population of Darwin has become more stable, transferred staff tend to stay longer and others have been engaged locally and are permanent Territory residents. It is not easy for an office in a remote area to maintain staff who are specialists in their particular fields of expertise. This had led to the practice of the firm in moving specialist staff to the Territory when
needed for specific jobs and in augmenting staff when required to undertake major projects. It is a flexible and convenient arrangement.

Robert Lloyd had left Darwin in 1983 after nearly ten years as manager in the Northern Territory, and was succeeded by Doug Hammerton who had been attending to the needs of country areas in Victoria.

Moving with the times under his guidance GHD in Darwin has been able to provide greater specialisation needed to handle a wide range of commissions in an increasingly sophisticated environment. Graham Sproats, who moved to Darwin initially for the civil engineering works on the Channel Island Power Station, was made deputy manager of the office. Lindsay Monteith, returned from Malaysia, moved to Darwin to look after water supply and sewerage jobs and has become the office expert on computer programming, with many novel approaches to his credit. Tom Rees fresh from Saudi Arabia, on road designs, and John Gersekowski on structural design, have complemented the work of 'old-timers' like Lech Powierza, and have provided enhanced capability in the office. The support of Lindsay Monteith has enabled John Matthews and his surveyors to develop new integrated approaches to the use of electronic equipment in the survey and design of power lines and roads, using up-to-the-minute technology. Bruce Hammond successfully opened the office and built up a practice in Katherine, while more recently Bert Saunders has established a thriving practice in Alice Springs. In all, GHD continues to play a very significant role in the development of the Northern Territory.

The climax of the work of GHD in the Northern Territory to date has been the design and project management by the Joint Venture GHD-Black & Veatch of the new Channel Island Power Station, probably the largest single project ever carried out in Darwin. This project, which is covered in another chapter, is nearing completion as this book goes to print.
King O'Malley Country

Citizens live in peace and honour

in Pearce and Higgins and O'Connor,
Campbellites drive Mercedes Benzes,
lobbyists shall multiply in Menzies —
but why not name suburbs for ideas
which equally have shaped our years?

‘The Canberra Suburbs’
Infinite Extension’
Les A. Murray (1928).

When the foundation stone of the Federal Capital was laid on Camp Hill in March 1913, King O'Malley was the man who handed Lady Denham a slip of paper which read ‘Canberra.’ In a clear voice she named the future city; it was then simply a dream in the middle of a great rural district.

O'Malley was a visionary, a Canadian who loved Australia and saw in it a future for millions yet unborn. His vision of Canberra was a city without a counterpart anywhere in the world and, in a way, his dream has almost come true.

The design plan adopted for the city of Canberra was conceived by a young American, landscape architect Walter Burley Griffin, following a worldwide competition.

Construction of the new city commenced in 1913 but was disrupted by two World Wars and the Great Depression.

Following World War II the strong desire to have a national capital city resulted in the establishment of a special commission in 1958 to develop the city.

The National Capital Development Commission, or NCDC as it quickly became known, enthusiastically undertook the task with the support of the then Prime Minister, Sir Robert Menzies.

Sir John Overall was appointed Commissioner and he, with his deputy Mr Bill Andrews, formerly the Parramatta City Engineer, gathered together a team of professional engineers, architects, planners and landscape experts.

The initial task of the NCDC was to review the concept design for the city. It was found that it was possible to adopt the original Burley Griffin plan and expand on it to meet all future modern day needs.

To assist the NCDC in the consideration of all planning aspects relating to the development of a major city a National Planning Committee was created, a small group of people who reviewed the many proposals brought forward.
GHD's first contact with the Australian Capital Territory was as a result of Geoff Davey's appointment to the committee, on which he served from 1962 to 1968.

The NCDC in its very early days adopted the strategy of retaining professional consultants to do much of the design and contract administration work and used private contracting organisations for construction. This enabled the NCDC to maintain tight administration control on all of its activities, giving its senior people time to concentrate their attention on matters relating to planning for the future growth of the Capital.

With the plan for Canberra fully reviewed the NCDC vigorously set about the construction phase and by the mid 1960s work had commenced on a wide variety of projects.

It was during this time that both GHD and D.J. Dwyer & Associates became involved with works in the Australian Capital Territory and it is a story of two parallel practices undertaking similar work for the same client in the one limited area.

Eventually the two practices merged in a rationalisation of staff and facilities with considerable advantage to both organisations.

Fred Machin set up the Canberra office for GHD in 1966 to enable GHD to participate in the growth of the new city, but work was slow in coming and it was necessary for him to seek jobs in the surrounding areas. This resulted in the Canberra office becoming responsible for what could be termed the South-East Region of New South Wales, stretching from Cowra and Young, north of Canberra, to the Victorian border.

It was not easy to break into a new area and jobs were not all that plentiful. One of the most satisfying projects Machin obtained was engineering work in connection with the city centre of the new satellite city of Woden. The Woden project was large and continuing but all in all the volume of work, although augmented by projects in drainage and road works, was not sufficient to maintain the range of engineering disciplines needed for the office to provide appropriate service.

Fred Machin retired in June 1968 after almost a lifetime of service to GHD. The management of the office then came under the control of Peter
Manger who arrived in Canberra on Australia Day 1969 and very quickly encountered the same problem — not enough work to justify the maintenance of a permanent office in the Australian Capital Territory.

Manger discussed his problems with Callinan, called for his support and got it. After a visit to Canberra by Callinan, the first real project was commenced — a report on the planning and development of Tuggeranong New Town. This was a major ongoing assignment which began in 1969 with investigations into sewerage and stormwater systems. GHD’s participation continued through broad-scale planning and landscape studies into the detailed planning, landscape and engineering design phase of this important new town. The work continued in this area and in October 1971 construction work commenced.

The significance of GHD’s studies into urban stormwater drainage runoff for the Town of Tuggeranong was heightened by the fact that in January 1971 seven people were drowned in the Woden Valley as a result of a flash flood. It was shortly after this sad occurrence that GHD was commissioned to do the Tuggeranong master drainage study with a review of the design parameters for major drainage works.

Work began in earnest for GHD in 1972 when the rapid growth of Canberra created a need for a significant increase in land development works to satisfy the housing demand. Major urban development works were commissioned, including projects in Belconnen and Mitchell and two additional suburbs in Tuggeranong.

In its desire to increase the rate of land development, the NCDC appointed a series of ‘area agents’ whose task was to coordinate all activities in designated areas. GHD eventually looked after three of these areas, and in one of these GHD was involved in the complete planning, survey and engineering. This was a ‘first’, as previously the NCDC had carried out all the planning itself, whilst the Department of the Interior undertook the surveying.

GHD was also the area agent for the entire area west of the Murrumbidgee River, where Crofton Hatsell was in charge. Hatsell later became the Secretary-Manager of the Latrobe Valley Water Board. Another area was the Tuggeranong Town Centre, for which John Cichacz was the job manager.

Emphasis was placed in Canberra on integration of development with the landscape. Tony Lewis and Gary Stanley were the first landscape architects to join the firm and worked on these projects.

One of GHD’s first computer enthusiasts, Bob Ford, worked in Canberra office at that time. His Olivetti computer had a flashing blue light to remind him not to enter further data while it calculated a trigonometric function — a task done instantaneously on a hand calculator only five years later.

Isabella Plains, a large area in the centre of Tuggeranong, was subject to extensive flooding, while the surrounding steep hills gave rise to ‘flash floods’. The trunk drainage works were essential for orderly development. The planning of the suburbs of Canberra, each with its shopping centre, school
and arterial road for the bus, resulted in all shopping centres being located in depressions and so subject to flooding if not properly considered. Bob Polley was responsible for vetting all major drainage designs. This was an arduous task requiring diplomacy, as construction was always ready to start on the ‘next day’.

By August 1975 the commissions in operation in the Australian Capital Territory were so large that staff in Canberra reached thirty-seven, with a further thirty working from Melbourne.

When Peter Manger left in early 1977 GHD in the Australian Capital Territory was a growing concern. His position was taken by Peter Rudd, who remained as manager until the merger with D.J. Dwyer & Associates in 1979, when Don Barr was appointed to that position.

Those were exciting days in Canberra for all projects were run to a tight schedule and the NCDC demanded maximum dedication and a high degree of professional skill from its consultants.

All consultants involved with the development of Canberra during the sixties and seventies gained significant professional satisfaction in working for the NCDC, which sought innovative ideas and encouraged consultants to take a broader perspective of the task at hand. This resulted in having engineering personnel relate closely to planners, architects, sociologists, landscape architects, economists, surveyors and a variety of suppliers and contracting organisations. It also had a significant impact on the manner in which consulting engineers undertook urban development projects as it encouraged consulting engineers to play a significant role in areas of management, the ‘area agent’ concept being one of these management tasks.

The practice of D.J. Dwyer & Associates was also fortunate to be present in the Australian Capital Territory and working for the NCDC during this important phase of Canberra’s development.

This shared experience, and the development of mutual respect between the two consulting organisations gained whilst working for the NCDC, were of great benefit at the time of their merging.

Don Barr, at the time of the merger, was manager of D.J. Dwyer & Associates in Canberra. For him it was simply a move from one office to another, except that after the move he was managing a larger practice.
The practice of D.J. Dwyer & Associates in Canberra also began in 1966 and during its early days was prepared to accept almost any type of work which was available. One of the first jobs for the new office was to carry out for the NCDC a rather mundane study of the relocation of bus stops. It was not the type of commission which would electrify engineers but, by the time it was finished, the staff of D.J. Dwyer & Associates had learned many lessons in diplomacy, at least on the National Capital level.

The project was to review all bus stops in the city, assess the suitability of their location and at the appropriate spots erect bus shelters. Apparently few people objected to bus stops as such, but as the capital is reputed to be a city of social strata, complaints flooded into the office from ‘concerned’ householders, on discovering bus stops placed in front of their own dwellings, stating ‘the position is unsuitable’ for a variety of reasons or ‘the bus should be routed along the next street’ for a further list of reasons, and so on.

Eventually all the bus stops were placed and all of the complaints attended to, in accordance with the ‘clout’ of the complainant. The complaints about the location of the bus stops were as nothing compared to the tirade which began when bus shelters were erected.

Apoplectic diplomats who suddenly found, in front of their residences, bus shelters in which ordinary run-of-the-mill people could shelter from the rain and wind, almost caused diplomatic ‘incidents’. Jim Pfeiffer was assisted on this job by Jack Dwyer whose years of experience and wise counsel enabled the work to be completed, but it was perhaps a warning to the new firm that things could be different in Canberra.

At the time of the merger, D.J. Dwyer & Associates had been working in the Australian Capital Territory for thirteen years. During this time they also played a significant role in the expansion of Canberra’s urban areas and, as with GHD, were appointed as area agents to control large sites destined to become residential estates or satellite city centres. The practice was strongly involved in the planning, design and supervision of various civil works and landscaping in a series of developmental projects including the relatively new town of Belconnen, north-west of Canberra City but within the Australian Capital Territory.
Belconnen at that time had a planned population of 120,000. The town centre is almost at the geographic centre and on the southern foreshore of man-made Lake Ginninderra. Engineering work included hydraulic services for sewers, water supply and stormwater, roads, bridges, underpasses, retaining walls, parking areas, traffic signals, stone-pitched batters, a pumping station and a large silt-retaining structure.

It was virtually a total plan for a large town. Services were provided to facilities such as the College of Advanced Education, Technical and Further Education College, government and private enterprise offices, a bus station, bus workshops and depot, police station and remand centre, fire station, ambulance station, fruit and vegetable market, services trades area, large retail shopping centre (Belconnen Mall) and both medium and high density residential areas.

An innovative feature of that plan was a district heating and cooling system for the air conditioning of government offices, with cooling water drawn from Lake Ginninderra and hot water returned to it through an old sewer main beneath the lake bed, with special outlets distributing the heated water. The intake, pumping station, rising mains and return system were all designed and construction supervised by D.J. Dwyer & Associates.

The residents of the beautiful city of Canberra have always been conscious of the importance of their environment. GHD, as a specialist in this field, has been called upon in Canberra quite frequently to assist in projects which could have an impact on that environment, as two particular jobs illustrate.

The Electricity Commission of New South Wales planned a high tension transmission line about thirty kilometres in length from a point about ten kilometres south of the city to a major substation at West Belconnen. The line was planned as far as was possible behind a line of hills, but in some areas the great towers, some up to twenty metres in height, were intended to stand starkly on the hills and would obviously be a visual pollutant.

During the design and planning stages, public awareness of the proposal threw up protest after protest at the danger to the environment and the visual pollution.

GHD was called upon to oversee the environmental aspects of the project and one of its staff, a qualified landscape architect, almost stood by the contractor daily while the work was in progress. The contractor was extremely good at his work but he believed that his job was to erect towers as quickly as possible and not be concerned with other matters — trees which were in the way or in near proximity to the towers should be removed and bulldozers should reach the job by the shortest possible route. The fact that this procedure caused damage to delicate grass coverage, with resultant deep ruts subject to further damage by rain, was of no concern to the contractor, that is until he went to Canberra.

GHD was very conscious of the problem. Only trees that would have prevented the laying of the foundations of the towers were removed and every metre of grassland was guarded as a valuable piece of property. Where towers stood above the skyline they were painted in colours to assist their blending
with the landscape.

When the line was completed there was not one complaint.

Similar environmental problems were overcome when the Queanbeyan City Council commissioned GHD to design a 22.5 megalitre steel reservoir at Jerrambombera. One of the problems was that the reservoir would be visible from the Canberra suburb of Red Hill, home of diplomats and many of the upper strata of Canberra society. The National Capital Development Commission became involved and GHD was instructed that the absolute minimum number of trees were to be removed from the site and on completion the reservoir should be painted in a colour which would enable it to blend into the background.

The job was finished with a specially prepared paint of ‘khaki-grey’ colour; the reservoir blends nicely into the hill. Cost of painting the reservoir was $130 000, almost ten percent of the total cost of the project. Norm Long and Andrew Kemp of the Sydney office worked on the design of the reservoir, the resident engineer was Tony Reid and Don Barr was the job manager during construction.

The merger of GHD and D.J. Dwyer & Associates gave a new thrust to GHD in Canberra; the acquisition of a larger staff and the bringing together of complementary skills have provided long-term benefits to the clients of both firms.

Working and planning in the Australian Capital Territory provides a variety of jobs so different from each other that the consultant engineer is prone to wonder, ‘What comes next?’

Massive buildings rise in Canberra with apparent ease and show no signs of stopping. In 1985 GHD-Planner West completed the extensive hydraulics and electrical design services for five of the office buildings in the huge Canberra National Convention Centre. The centre includes a plenary hall to
cater for 2500 people, a 300-bed hotel, an office complex comprising six major buildings with a total nett lettable floor area of 5500 square metres and landscaped areas incorporating gardens and water features.

At the other end of the scale, the Canberra office of GHD applied itself, with the same enthusiasm as would be expected for more spectacular jobs, to the design for the upgrading of the water supply and fish ponds at the Gaden Trout Hatchery near Jindabyne, New South Wales. The hatchery is operated by the NSW Department of Agriculture and produces fingerlings of trout and Atlantic salmon for distribution to streams and dams throughout the State.

A constant flow of fresh water is required to successfully breed trout and salmon and a high ratio of silt and debris entering the small diameter pipes leading to the hatching trays would reduce the flow of water, resulting in loss of ova and fry. Debris shields to catch floating material were installed, together with an automatic alarm system to alert the staff to any decrease in the fresh water flow. The broad ponds were improved by the installation of gravel floors, providing less chance of the intake of mud to the gills of the fish.

Not a big job, one might say, when comparing the cost with that of, say, a new parliament house, but it depends entirely on one’s point of view. The rabid trout fishermen of Canberra, if asked to make a comparison on a scale of 1 to 10 between the fish hatchery job and other projects, would come back straight away with the answer, ‘The trout hatchery job was over the top!’

I like to think of one of GHD’s little projects in Canberra as being something special; it probably isn’t, but I like to think so anyway. Perched on the top of Mt Ainslie, overlooking the beautiful city, is a fifteen metre tower holding a rotating aircraft beacon at its top. The graceful little tower was designed by Peter Manger and, sitting on the very top of the mountain, is 846 metres above sea level. The flashing beacon is used as a guide for aircraft, assisting them to bring their passengers safely in to land; I like that.

In some two decades of operations in the Australian Capital Territory, GHD directors believe they have made a significant engineering contribution to the Territory and it is clear that they will continue to do so.
Go West Young Man!

They are faint in the burning noonday, and weary when day is dead;
They have never a thought of resting till hope from their hearts has fled;
They are toiling — some for a sweetheart, and some for a home and wife;
And many are striving for riches, and some are fighting for life!

They are dying beyond Coolgardie in sight of their untouched prize,
With no one to break Death’s tidings, and no one to close their eyes;
They lie in the scrub and the sand-wreathe, with never a stone to mark
The grave where the bush-crows gather and the dingo crosses at dark.

‘Beyond Coolgardie’
Will Ogilvie (1869-1963)

‘State of Excitement’, the catch cry of many in the western third of our continent, could have a double meaning for visitors to that State. This massive part of our land seems to have everything and a little more, including either the romance or the immense distances, depending on one’s age.

Visitors may become excited by the wildflowers, mile upon mile of them, by the extensive forests of jarrah and karri or by the beauty and colour of its scenery. If not excited then most visitors, except the most blase, are awed by the huge distances, the mind-boggling reserves of iron ore, gold, bauxite and diamonds still waiting to be wrenched from the soil, and by the changing terrain of the State. The country includes arid desert, huge areas of wheatfields, majestic forests, sweeping plains and natural harbours. It stretches to the romantic hills of the Kimberleys, where Aboriginal people live and in some areas regard the white man as a temporary intruder.

The people of Perth live in the most remote capital of the western world and the isolation has had a profound effect on their lives and the way they
think. Perth residents can and do travel to Indonesia or Singapore as quickly, and certainly more cheaply, than to the eastern cities of Australia.

The remoteness has bred an independence of thought and a belief that they are not only capable of ‘going it alone’ but that they should do so. Time and time again the cry has arisen that Western Australia, separated from the east by its natural barriers of desert and the Nullabor Plain, should become an independent country, beholden only to themselves; they may well have a point.

To survive in Western Australia the people have had to face and conquer their harsh environment. They have done this, and in the forefront of their march forward it has been the engineers who have used ingenuity and determination to conquer the isolation and to provide innovative works which have ensured that the State’s resources have been developed for the benefit of their State.

After completing some isolated projects GHD opened a permanent office in Perth in 1975. The original office was not very grand; total staff, one man — Tom Swanson. It could be rather daunting for a consulting engineer to find himself in a one-man office with the task of winning commissions in a State as big as Japan, the United Kingdom and the State of Texas combined. A further sobering thought was that there were a number of highly skilled and enthusiastic consulting engineers already operating, at least in the capital city of Perth.

Quite separately, Don Dwyer had established a small consulting office in Perth in 1972, encouraged to do so by the offer of work for Hooker-Rex, who were preparing to develop subdivisions in new suburbs. Gradually they increased the number of clients, who were impressed by the quality of work produced under the watchful eye of Graham Mackie. A major breakthrough came in 1977 when D.J. Dwyer & Associates, in conjunction with USA consultants, was awarded the design and project management of a $12 million sewage treatment plant south of Perth, winning the work from the separate proposal by GHD.

When in 1979 GHD merged with the eight-year-old local branch of D.J. Dwyer & Associates under the new name of GHD-Dwyer (WA) Pty Ltd, the staff of the new company numbered twelve all told. Prior to the merger D.J. Dwyer & Associates had built up a sound record of work in the areas of land subdivision and associated works.

When the two companies combined, the Worsley and the Perth sewerage projects provided the foundation of skills, management and manpower, equal in most respects, and superior in some specialised fields, to those of other local firms. The combination of both names in the company recognised the skills and client base of the earlier companies and became the name upon which the local company’s reputation was built.

The major breakthrough came with the Worsley Alumina Project in the south-west corner of the State, where GHD was asked to undertake responsibility for both the technical and environmental success of the $40 million water management for the new $1000 million refinery near Bunbury.
Three of GHD’s Victorian engineers (Strom, Phillips and Fricke) and Swanson proceeded along narrow bush tracks to the proposed site. To the surprise of the American client who accompanied them, the four engineers disappeared into the bush in different directions, one to look for dam sites, another to find a site for a stream gauging station, another to check geological conditions, and another to assess environmental factors. From time to time an engineer would reappear, covered in black from the bush which had suffered from a bushfire, only to disappear in another direction. Bemused, the American engineer stayed near the vehicle. Nevertheless, he must have been impressed by the keenness of the GHD engineers, for $40 million of dams, channels, residue ponds and pump stations was placed in GHD’s care — a project which provided the springboard for a major advance for the firm in Western Australia. The project was later to win two prestigious engineering awards.

After their revolutionary work on ‘tailings’ (waste) at the Worsley Alumina Refinery, the firm was engaged to look at tailings at the Argyle Diamond Mine in the Kimberleys.
The Western Australians of GHD have now become so expert in the
treatment of tailings from mines that they have even worked on projects in
Queensland for the giant Comalco and the Kidston Gold Mines. In the Perth
office library is one of Australia's best collections on the treatment of tailings,
to support probably the leading group of engineers on this subject.

At this time John Phillips shifted with his family to the West, not only
to take charge of the Worsley project but also to head up the local Board
of Directors, so necessary to ensure the smooth running of this remote yet
flourishing office. With him, of course, went the experience from a great
variety of GHD projects undertaken in the eastern States.

In recognition of the remoteness of the West, the small office was given
the status of a GHD Region, with three local board members — Phillips and
Swanson from GHD and Mackie from Dwyers. Ben Fink and Don Dwyer also
became directors to provide the necessary interstate support for the fledgling
region. Shortly after, Phillips took over the role of managing director for
Western Australia.

In the summer heat of Perth, Phillips and his small family spent a lot
of leisure time relaxing in the shire swimming pools. He was quick to see that
many of the local pools were in need of repair and that there was a need for
more swimming pools, particularly indoor ones.

GHD-Dwyer captured the swimming pool market by talking to the shire
councillors in the same way that Gutteridge had done fifty years before.
Phillips would discuss a full service, cost studies, design, architecture,
landscaping, project management and so on with an estimate of full costs
and construction time to have the pools in operation. The councillors were
delighted. Could GHD-Dwyer make urgent repairs to the pools in the shire?
In other cases, could an appealing yet economical indoor pool or recreational
complex be built for the shire? GHD-Dwyer could and would be pleased to
accept the commission, that would give the right facility at the right price.

An offshoot of the swimming pool projects has been the growth of
structural engineering projects requested of GHD-Dwyer by the architect
designing the swimming pools. This may not be so much a quid pro quo or
'payback' but a realisation by the architects of the advantage of working
cooperatively with GHD-Dwyer. The projects in this field have ranged from
colleges to hotels, the Perth Dental Hospital, multi-storey office buildings,
and others.

Western Australia is certainly different in many ways from the eastern
States.

I asked John Phillips about their interest in subdivisions and housing
estates, a field already well established by D.J. Dwyer & Associates prior
to the merger with GHD. My question was mainly related to the provision
of water and sewerage facilities.

Perth is virtually built on sand and has a very high watertable. Houses
in the new estates generally do not require facilities to carry off stormwater.
The collection of rainwater from the roofs is simply piped on to the ground
and disappears into the soil. In the summer householders pump the water
from the watertable to keep their gardens green!

Sewage is treated in much the same way. Thirty percent of households have septic tanks and local regulations protect the resident from a polluted watertable by requiring the tapping of underground water to be a good distance from the septic system. Nevertheless, there are some poorly drained areas, and suburbs with a high density of population, and for these conventional sewerage systems are essential. Sewerage works remain an important part of the GHD-Dwyer practice.

The provision of roads in a State as large as Western Australia is a nightmare due to high costs of construction coupled with a small population of taxpayers. The Federal government, however, provided funds for an entirely new 450 kilometre National Highway from Newman to Port Hedland as a bicentennial project.

One section of the new highway, at Munjina Gorge, is one of the few mountain highways in Western Australia and is within the beautiful Hamersley National Park. The road, designed by GHD-Dwyer, is through a gorge seventy metres deep. The road had to be literally hewn from the rock for one kilometre, with more than one million tonnes of rock and rubble being removed. It was a challenging project. The massive cliffs overhang the road and the danger of collapsing cliffs and landslides during construction or during earthquakes required innovative design techniques to protect workmen and
travellers.

One of the specific instructions to the engineers was to preserve the aesthetics of the landscape. The ultimate aim was to ensure that the new road blended into the landscape, almost as part of it. The cutting walls were actually sculptured to reflect the forms of the nearby gorges and drainage lines were aligned to create waterfalls after rain.

The Munjina Gorge project won the 1987 Engineering Merit Award of the Association of Consulting Engineers Australia, Western Australia Chapter.

In 1981 Phillips opened a branch office of GHD-Dwyer at Bunbury and the locals were quick to appreciate the service. The permanent presence in the town of a consulting engineering practice having local expertise supported by national resources sparked off a renewed approach to many engineering problems, both from the public and private sectors, and the office which had a staff of five continues to grow.

The opening of a second branch office at Port Hedland, 1500 kilometres north of Perth, almost bordered on the impertinent, but it also has paid off.

Port Hedland is part of the Wild West. Surrounded for hundreds of kilometres by desert and situated hundreds of kilometres from other towns such as Marble Bar, the hottest town in Australia, the entire staff of one, Robert Jackson, covered the countryside in a four-wheel-drive vehicle to win commissions from a surprising number of clients.

There were no other consulting engineers at Port Hedland, which is the end of the 425 kilometre heavy haul railway which brings iron ore from Mt Newman, with another line bringing ore from Goldsworthy and Shay Gap. The loading of the ore and the maintenance and upgrading of the seaboard facilities and the township has ensured the success of the new office. Nearby, the operations of the Leslie Salt Company make use of the extreme evaporation and the flat land to produce salt and, at the same time, provide further support for the town.

Robert Jackson established this, the loneliest office of GHD. It is a district of eyeball-bursting heat, of lack of rainfall and of oddities of nature such as the seven metre tide which will leave a boat stranded on the harbour bed for twelve hours; for all that, he liked it. ‘Wouldn’t be anywhere else,’ he said, surely a comment made during the mild winter season.

Following a similar philosophy of serving local communities, offices were also opened in Karratha and Geraldton. Two more lonely offices, hundreds of kilometres from each other, but reflecting the pioneering spirit that has opened up this State.

The recent acquisition of the survey practice of Fisher Lewis, operating from Perth, has broadened the scope of the Western Australian practice, and the addition of town planning and electrical engineering now enables the practice to operate throughout the State in the same manner as the eastern States.

The Western Australian practice of GHD-Dwyer has now come of age, but the excitement continues.
We want the man who will
lead the van
The man who will pioneer.

‘An Australian Advertisement’
Henry Lawson (1867-1922)

Loss Assessment

In a Victorian port on the afternoon of Friday, 28 May 1948, a fatal accident occurred on S.S. Artemisia when a bullrope broke on the starboard derrick serving No. 2 hatch. It was a serious matter and GHD was commissioned to report on the cause of the accident, to ascertain whether it was the result of equipment failure or human error. The report was duly made and the reputation of GHD as an investigator was established.

In 1978 the construction of the Maui Natural Gas Pipeline of New Zealand, a new venture for that country, had produced unforeseen problems. GHD was called upon to prepare an independent assessment of extensive insurance claims.

The pipeline stretched 390 kilometres from Oaomui in the south to Auckland in the north. The terrain was of a volcanic nature stretching through heavily timbered country. The consistent rainfall averaging 2900 mm in the project area presented many problems by increasing the instability of much of the route where deep cuttings had to be made.

The two hundred kilometres of the more rugged terrain included three hundred stream crossings including sixteen aerial crossings and forty-four buried crossings of major streams. The elevations of some of the valleys ranged between 150 metres and 450 metres and, in the steep slopes of what is geologically an unstable area, slips and slumps were frequent. As if these problems were not enough, the pipeline crossed an area of intensive farm cultivation where the farms had to be treated as if they were precious stones. Fences were relocated and the irreplaceable topsoil was removed, placed carefully to one side and then just as carefully replaced, all under the critical eyes of the farmers.

The project was a contractor’s nightmare and it became apparent to the underwriters, from the number and size of the insurance claims, that the insurance assessors would need to have engineering support to make just decisions. GHD was commissioned by Continental Insurance Companies (USA), project insurers to Maui Development Ltd, to review the conditions affecting construction of the pipeline, including climate, terrain and design. Included in the commission was a request to review all claims made to that time.
The findings of GHD by one of its engineers, Ray Maxwell, enabled the underwriters to assess their future risks and provided a basis for improved specification and inspection procedures for the project owners. It also allowed the underwriters to factually and independently assess the extensive and costly claims made.

The obvious integrity and independence of the findings has since brought similar requests to GHD to act again as independent adviser to underwriters and assessors on other projects.

Fried Chicken?

Consulting engineers do not normally interest themselves in chickens or chicken farms but Norm Traves, when manager of the Cairns branch, did just that and earned himself the gratitude of a local chicken farmer.

Tom Crawford and Sons ran a large poultry farm on the bank of the Barron River at Stratford, near Cairns, North Queensland. It was a good farm, free of disease, producing table poultry and eggs for the local market. In big floods Tom’s farm was surrounded by water.

In March 1967 there were record floods in far North Queensland, the result of thirty inches of rain (on the old scale) in three days (whew!) on the east coast and the Atherton Tablelands. Tom had just installed new cages on the farm but a flood of more than two metres was too much. He lost thousands of chickens — a total loss. He called in GHD to see if there was a way to prevent future losses. Norm Traves calculated the density of chickens per linear foot of perch and a weight per chicken. He designed a raft of fabricated and sealed hollow tubes to support a system of wooden perches. The raft was designed to rest on the floor in normal conditions but rise with the water if another flood came along.

In due course floodwaters came swirling down the Barron River. The chickens hopped onto their perches and the rafts simply floated up within the cages. Result — no dead chickens and another very satisfied customer.

Tunnel of Love — Luna Park

In the late 1930s GHD prepared the plans for Luna Park, Sydney, of a new type of park attraction, the ‘Tunnel of Love’. It was an unusual project and GHD was pleased with the result. The owners of the Park were not so pleased. They were less interested in the romantic overtones of the tunnel as in the number of boats that would traverse it in a given time. They argued that the boat trip was too slow, much more so than GHD had originally led them to believe. GHD was sued for consequent loss of earnings due to faulty design.

Gerald Haskins refused to believe that the original design of the tunnel by GHD was wrong. He had a scale model of the tunnel built in his offices on the third floor of Asbestos House in Sydney. He found that the contractor who had built the wooden channel had placed cleats on top of the floor instead of beneath it. The cleats produced turbulence and consequently reduced the
number of trips made by the 'love boats' and, of course, reduced the takings at the till. The scale model was about 3.3 metres square and was quite a success other than, in the first attempt to fill it with water, it was found not to have been properly sealed. The tenants on the first and second floors of Asbestos House were not pleased with their own version of The Flood.

The model was subsequently exhibited in Court and GHD won its case.

Fisheries Tank Aids Research

GHD in Tasmania was project manager for a flume tank and fisheries training centre which began operating at the Australian Maritime College, Beauty Point, north of Launceston, early in 1984. The flume tank tests fishing appliances, mainly trawl nets, on a 1:10 scale. The tank itself is thirty metres long by five metres wide.

The speed of the trawl is simulated by circulating water around the tank at speeds up to 1.5 metres per second. There is a 'sea-bed conveyor' below the test section and viewing area which can operate at variable speeds to simulate conditions at the sea bottom, with or without tidal influences.

The flume tank is very similar, in hydraulic terms, to a unit developed by the Sea Fish Authority Association at Hull in England. The Beauty Point facility differs, however, in detail. In particular, the different foundation conditions required significant variations in structural design. GHD's Tasmanian director, David Skillington, visited the Hull tank in 1982 and was impressed with its usefulness as a practical aid in the scientific instruction of fishermen.

Like its counterpart in the United Kingdom, the new tank incorporates large viewing windows through which operations can be seen and measured, as well as an overhead trolley allowing vertical measurements and
observations to be made from above the tank. Flow control is by four 100-kilowatt vertical propeller pumps, conditioning screens and boundary layer ducts.

The flume tank is associated with a fisheries school building comprising laboratory teaching areas and administration offices.

Tony Lewis of GHD Melbourne was responsible for architectural treatment, with engineering design work by GHD Hobart and contract administration and site services by GHD Launceston.

What The Eye Doesn’t See

Prior to World War II Gerald Haskins invited the NSW Minister for Local Government, the Hon E.S. Spooner, to the Grand Opening of the Coffs Harbour Augmented Water Supply.

It was to be a very big deal for the then small town. A stage was built to accommodate local dignitaries and their wives, the lectern was prepared and a handsome pewter pot with appropriate wording engraved was purchased as a presentation to the Minister.

Mr Spooner made a great speech praising the consultants, the workmen and the townspeople for their assistance, not forgetting the New South Wales government which had contributed to the cost of the scheme. As he was saying, ‘When I turn this valve, water will commence to flow into the reservoir’, the contractor for the construction sidled up to Ken Inglis, the resident engineer, who was standing behind Gerald Haskins on the official dais, and said, ‘The supply main has broken outside town — there is no water.’ Inglis passed the news on to Haskins, who simply commented, ‘What a bastard!’

It was fortunate that nobody could see into the reservoir. Amid the loud cheers of the natives, Mr Spooner turned on the tap. Face was saved by all — nobody ever knew that the water did not flow.

Twenty Stone At An Angle of 45°

John Ryan, manager of the Darwin branch from 1963 to 1968, usually preferred as much detail as possible before embarking on a design project.

During his term at Darwin he was advised by the Northern Territory Reserves Board that some tourists were having difficulty in climbing the steep grades of Ayers Rock. They were worried at the possibility of accidents. Could GHD design and install a safe handrail please? That was the extent of the technical data provided by the Board.

Ryan made his calculations using a theoretical man weighing twenty stones (127 kg) holding on to a rail at an angle of 45° The contractor was an electrician, the only technical man available in the district; he bored holes into the Rock for posts and strung a heavy chain between them right to the roof of the Rock. The chain held fast even when a twenty-three stone man climbed to the top! An ‘off-maintenance’ inspection carried out by John Ryan in 1984, just twenty-one years after construction, revealed no deficiencies.
The Annan River Bridge is Falling Down

Well, it nearly fell down anyway! The Annan River Bridge, Queensland, was of wrought iron, built in Scotland in the 1890s and erected on the Annan River in that decade. It was an important bridge; it carried the heavy mining traffic south of Cooktown prior to the turn of the century.

The bridge had been a very strong structure. The piles were of cast iron and were screwed by hand seven to eight metres into the muddy bed of the river. The decking was of solid timber.

GHD was commissioned by the Main Roads Department to check on the stability and safety of the bridge. The Department was concerned as to its condition. Norm Traves and John Ryan of the Cairns office inspected the bridge and took a diver with them to test the strength of the screw piles. They stopped the testing after the diver reported that he had pushed a screwdriver through the cast iron of the first three piles he had tested.

Traves and Ryan reported to the Department that one way of overcoming the problem, perhaps a little unorthodox, would be to fill the cast iron piles with reinforced concrete.

The bridge is still in use and is regarded as part of our engineering heritage.

Well Worn But Worn Well

In 1958 GHD's Cairns office was asked to design almost a complete water supply for the old frontier town of Charters Towers. It was not the new project which was exciting, although this included new pumps, new electrical system and the laying of a second pipeline to the town; it was the ancient water supply which intrigued John Ryan, project engineer. The original town water supply, which was still working, had been built in the 1890s. The original steam-powered pump was in perfect condition, as were the original cast iron pipes imported from the United Kingdom over seventy years before.

Ryan told me that the overseer to the system was an old-world character who looked as if he was at least as old as the water supply — and probably was.

Corkscrews for Wool Bales

Most people would consider that the obvious use of a corkscrew would be to open a nice bottle of wine for dinner; it's a splendid idea and some advocate that there should be more of it, but corkscrews have other uses.

The administrators of the huge Yennora Wool Centre in Sydney, New South Wales, had a real problem in arranging thousands of bales of wool into the correct position for marketing.

In the wool season the long trains pull into the centre and the enormously heavy bales not only have to be unloaded but, for selling purposes, must be stacked in 'clip' and in grades of wool. If a grazier sends in fifty bales of wool in three grades, the fifty bales must be marshalled into three separate sections so that buyers can see the quantity of bales available for sale or auction.
Planner West (now merged with GHD) as part of their engineering of the total project designed a system under which giant corkscrews, attached to an overhead rig, were screwed directly into the bales as they lay in the wagons on arrival. The bales were then lifted onto to a sorting table, which was the second part of the system designed by Planner West. The corkscrews did no harm to the wool and the bales, once deposited on the sorting system, were easily and mechanically sorted by a single operator into batch or clip lots ready for display.

The Torres Venture

When GHD staff, Grahame Bruce and Ralph Hawkes, reported in 1974 that transport facilities in the islands were seriously deficient, the Torres Shire Council and the Torres Strait Co-operative requested financial help, which was granted from the Department of Aboriginal Affairs. GHD was commissioned to draw up specifications for a shallow draft landing barge.

The *Torres Venture* made its maiden voyage to Thursday Island in 1977 and immediately commenced service in the Torres Strait.

The vessel was ideal for its purpose. Twenty metres long, with a six-metre beam, it drew a maximum of 1.5 metres fully laden. Carrying capacity was provided for twenty-five cubic metres of wet sand which could be stowed in a special bin in the well of the vessel to give free deck space for the carrying of other cargo.

Accommodation and ancillary equipment was required for a crew of four, with an extra cabin for a supernumerary crew of two and separate accommodation for the Master. Steering was hand hydraulic and the bow door and anchors were power-winch operated.
Standby generating equipment allowed for power and lighting, either AC or DC, and an additional generator provided capacity for the carrying of containerised refrigerated cargo. A deck-mounted crane operated a 0.6 cubic metre clam-shell grab over the side of the vessel for the winning of sand from the seabed. The crane jib was hinged at midsection and, when not in use, was parked athwart the vessel.

The *Torres Venture* became one of the lifelines of the Torres Strait Islands. The people of the Islands swore by it.

**Prawning With a Difference**

In 1974 GHD prepared a feasibility report including estimates of cost for the engineering aspects associated with the establishment of prawn cultivation ponds at Port Douglas. This was the beginning of a continuing involvement in prawn aquaculture projects. Prawn aquaculture is a scientific method of breeding and farming ocean prawns, a method not widely used in Australia.

In 1984 GHD Townsville office became involved in this rather novel form of farming when it prepared an environmental impact report on the establishment of a major prawn aquaculture project in Townsville for a Sydney-based Chinese company with overseas affiliations. The report was a prerequisite for approval of the venture by the Queensland Department of Primary Industries. Approval was subsequently granted and was believed to be the first such approval in Queensland. The initial development involved ten hectares of ponds, with a further ten hectares to follow later. Pending the success of the pilot stage, land requirements were planned for an ultimate development of about one hundred hectares.
The following year GHD was commissioned to design structures associated with a planned Aquaculture Research Centre in southern Queensland. The Queensland Department of Primary Industries proposed to construct the centre on a fourteen hectare site on the east coast of Bribie Island. The commission included provision of design and detailing services for the initial phase hatchery complex and laboratory/support buildings including project management of all off-site building fabrication.

In the same year the firm was commissioned by Australian Prawn Farms Ltd to provide survey and preliminary design for the proposed Point Ceylon Prawn Farm. Point Ceylon is on the west side of Bynoe Harbour, west of Darwin. The project involved developing a site of 405 hectares, of which 160 were proposed to be developed into lagoons.

The firm has also been associated with the growing of freshwater prawns. In 1980 GHD designed two ponds associated with a pilot study for growing freshwater prawns in the Northern Territory.

In addition, GHD has also been involved in fish aquaculture projects, the most notable being the Walkamin Fish Project in North Queensland. This project covered research and quarantine facilities for Nile perch and other exotic fish species at the DPI Walkamin Research Station on the Atherton Tableland. It involved the importation, breeding and evaluation of Nile perch for later release into Queensland waters. Nile perch, which is native to the Nile River system of Africa, is a close relative of Queensland’s famous barramundi and is considered suitable for stocking in large dams and streams. Strict conditions of quarantine and security are necessary to ensure that it does not pose a threat to Queensland’s native fish.

GHD’s involvement included initial design and construction phase services, as well as the preparation of the preliminary report and design concept. The Walkamin Fish Project was operational in July 1984.
‘Find me some debris’ the surveyor said

One afternoon five miles out from the town
One fine dry afternoon as far from flood
As we from Noah. ‘Something must be found
To back these levels,’ the surveyor said,
Stooping to part the grass and seize upon
Fragments of bark and water-polished wood.
‘Something like wreckage’ the surveyor said.

‘Chainman’s Diary -
Flood Levels’
Bruce Beaver (1928 - )

It is probably true of any consulting engineer that, if he can’t find the right tool or equipment to solve a problem, he will invent a new tool or improvise. It will always be so because Mother Nature, with whom the engineer is constantly wrestling, has little concern for text books.

Throughout the years the engineers and surveyors of GHD have been confronted with projects which, by text book rules, should never have been completed. By introducing new methods, using local materials and by sheer ingenuity, the jobs have been completed and in their completion have set new rules.

GHD makes it a policy to use the most modern equipment available to its engineers and surveyors and tries to follow up-to-date techniques for solving engineering problems.

The tools and equipment used by GHD have ranged from the mundane surf ski to the most sophisticated.

Sometimes, however, lack of basic data is a handicap.

The hydrology aspect for the design of the Einasleigh River Bridge in Queensland presented at least a new twist to GHD engineers. Records of rainfall were sparse and records of river water levels and floods just did not exist.

Enquiries indicated that the most detailed information available locally on depth and duration of the flooding was that, ‘She’s a swim for a horse for about three months, most wet seasons.’

This enabled the engineers to form some rational opinion on the depth of flooding and duration of flood flows, to support their theoretical calculations, and so assisted in establishing the necessary levels of the bridge deck.
It's quite easy!

The West Wyalong sewerage scheme, completed in 1937, was the first sewerage scheme in Australia to be designed from aerial photographs. Geoff Davey decided that the new approach would speed up the surveys after a lot of time had been lost on that job as a result of wet weather.

He chartered a light plane from Adastra Airways and Cliff Brewer placed photo control targets in the town. One of these targets was placed right in the centre of a large vacant lot in the main street of the little town. The day before the first photographs were to be taken George Sorlie’s Circus came to town and placed the circus marquee over the marker. The delay was slight; in two days the circus moved to the next town and the target was once more visible from the air.

The photographs were used to prepare a detailed plan of the town.

Another example of GHD’s resourcefulness was in the use of surf skis for surveying.

The redevelopment of the Cairns airport required a large volume of fill and the Cairns Port Authority commissioned GHD to carry out a hydrographic survey at Ellie Point, near the airport, to evaluate the volume of hydraulic sand fill available for dredging and, in particular, for use on the airport project.

The coastal area surveyed was a rectangle of approximately 800 metres seawards by 1200 metres parallel to the shore. It was almost completely exposed at low tide and for most of the available working time water levels were too shallow to float any type of boat. Movement on foot was hindered by the fact that the seabed over much of the area was very soft. Field assistants could not move quickly from point to point on the fifty metre grid as their feet sank well into the seabed with each step; access to the baseline on shore was very difficult.

The use of surf skis to improve the mobility of the field assistants was the thought of Rod Shore and Paul Callaghan, two surveyors from the Cairns office, who spent most of their leisure time on surf skis anyway. Rod and Paul were responsible for most of the field work. They used electronic distance measurement equipment to radiate from shore baseline stations to field assistants carrying reflectors on poles. Base plates were attached to the poles to prevent their sinking into the soft seabed material.

Field assistants were able to paddle from point to point on the surf skis, which then served as stable platforms from which they could support the measurement staves. It has been said, but not authenticated, that during the heat of the day the surveyors were wont to fall off their surf skis more often than would have been expected.

As early as 1935 the ingenuity of the firm’s founding fathers was restlessly seeking solutions to their current limitations on materials and systems.

Letters Patent No. 24.849 of that year were granted to Geoff Davey and Gerald Haskins for a pipe system for pipes ‘some feet in diameter’ which utilised ‘fibro-asbestos in particular, but also other mouldable non-metallic
substances.

At that time, small diameter asbestos pipes were being produced, but for larger diameters the necessary material thicknesses made asbestos uncommercial.

The Patented System followed the principles of older wood stave pipes in that bursting pressures were contained by external spirally-wound steel tendons or bolted adjustable peripheral steel bands. The longitudinal asbestos stave sections were linked at jointing points at one, two or three locations around the circumference.

Research has not confirmed whether the system was ever used commercially.

On a hot summer afternoon in the dear dead days prior to World War II, GHD surveyor Cliff Brewer was in the pub at Temora. It was the only sensible place to be; the temperature had burst through the 100°F mark.

'The bathrooms are still open,' the barman remarked. 'Why not take a shower? The beer won't go away!'

Cliff and the shire engineer agreed that a shower seemed to be a good idea but in continuing the conversation later they found that in the adjoining towns the bathrooms in the pubs were closed due to the lack of town water supplies.

'Why don't those towns have a water supply?' asked Cliff of the shire engineer. 'We had a report about twenty-five years ago', was the reply. 'It said that it couldn't be done.'

Cliff Brewer became excited, not a good thing in that heat, and rang Haskins in Sydney to discuss the matter. Haskins arrived the next day, still in the heat, asked for and obtained an immediate meeting in the pub of the Town Council. Between cold beers, paid for by Haskins, the councillors agreed, 'Yes, it would be good to have a water supply in all towns in the shire. Could we have a report please?'

Haskins did better than that. He embarked on a massive public relations exercise which involved visiting every town in the shire without a water supply. He charmed the civic fathers and he charmed their wives with bouquets of flowers, for many probably the first they had ever received.

GHD got the job and requested Cliff Brewer to organise the surveys. There were no plans of levels in the shire and all he could find were some very ancient land development maps. Cliff then collected the local railway timetables, on which were shown the heights above sea level for each station. From this rather crude datum material he obtained the levels for the whole shire and was able to select the site for each reservoir. He got on with the job and the district finished with good water supplies and with all pub bathrooms open even in the hottest weather.

Engineering projects require surveys; they are as basic as a pen to a writer or petrol to a motor car.

GHD for many years has had a great number of projects in operation in all States and overseas on a continuous basis, needing a large number of surveyors. Indeed, by the early sixties the GHD team of surveyors was
numerically the largest in Australia. The speeding up of surveys meant more working time for design engineers and a healthier opportunity to keep within the estimated time of completion of the job.

In what may be called the ‘old days’ the surveyors and their chainmen lugged their equipment over their shoulders and walked from point to point to take their measurements and levels. Their field data was sent to the mapmakers in the offices to prepare the maps for the engineers.

Geoff Davey, with his aerial photographs, made a big step forward, but surveys of this type were not suitable for every job at that time. The first really big advance was the introduction by Jim Trench of techniques for plane table surveying, which could produce maps in the field. There were no more delays at the offices; the engineers received the plots and were in a position to start their work immediately.

The productivity by the plane table method was greatly increased by the invention by Ivan Miller of a special protractor known as a stadia protractor. Surveyors in GHD became extremely skilled at producing maps by the plane table method, and some hundreds were prepared throughout Australia in the 1950s and 60s, particularly for the design of sewerage schemes.

Control surveys using electronic distance measuring equipment (EDM) were a further progression and are widely used at GHD, but the more recent and widespread use of photogrammetry is to a layman almost ‘Star Wars’ stuff.

The application of photogrammetry is the production of detailed and contoured topographic maps from aerial photographs using stereo plotter instruments. Since 1967 GHD has been active in this field of mapping for engineering projects and government mapping programmes. Phillip Meinhardt, the chief photogrammetrist, undertook a postgraduate course in photogrammetry at Delft, in The Netherlands, and is making a valuable contribution to engineering photogrammetry in Australia.

The installation in 1983 of a computer-based photogrammetric system has provided GHD with the means for a further significant increase in productivity in mapping which results in time and cost savings to the client. This latter aspect is of great importance in an inflationary world.

The system also provides the capability of terrestrial photogrammetry, which is finding increasing application in the measurement from ground photographs of historic buildings and monuments and of complex engineering and industrial structures for design data and monitoring during construction.

The impact of technological change in surveying in the 1980s has been quite revolutionary and GHD has taken the step into the future by the acquisition of a number of electronic and computerised survey systems.

No longer does the surveyor have to drag around a steel measuring band and strain the eyes to read the angles from the theodolite, and then laboriously pencil all the readings into a field book for later reduction before handing to the draftsman for plotting.

Now at the press of a button and a few seconds labour, the electronic distance measuring and theodolite equipment has automatically observed and
recorded the distance and angular measurements into a field data recorder, which is later unloaded into the office computer for the reduction and plotting of the survey plan — all without putting pencil or pen to paper.

The total survey system has tremendous versatility and potential, and software for specific specialist applications is being developed by GHD staff.

Darwin office engineer Lindsay Monteith and surveyors John Matthews and John Rowland have developed the system for electricity power lines so that the operations of data collection and reduction, engineering design and set-out information are done in the field, and on return to base this taped data is then unloaded into the computer for the final plotting of plans and sections.

Ivan Miller, as director of surveying and photogrammetry, believes that the introduction of this advanced technology by GHD has presented new challenges for surveyors and provides the opportunity for further development of this segment of the practice. GHD has proved the success of the programme by the increasing list of clients from government, local government and private enterprise.

The engineers and draftsmen of GHD are also making good use of modern electronic equipment and processes which are becoming available in their fields. GHD engineers have used computing equipment in the design process since the late 1960s, initially with a single work station minicomputer in-house in Sydney and making extensive use of external computer bureaux.

By 1980 it was apparent that the firm should be making use of computer-aided drafting (CAD) systems which had appeared in the marketplace.

The installation of a CAD system is quite a major and costly step, so the various possibilities were examined in detail before the decision was made to install in Sydney office the Autodraft (now known as Palette) system. This was an Australian product with perceived advantages, including the availability of the vendor to assist in solving problems that might arise. The system with a minicomputer, two graphics work stations and a plotter, with the necessary software, was installed in Sydney in 1981.

Changes occur rapidly in the computer field, and by 1986 a larger minicomputer with four work stations was installed in the Sydney, Melbourne and Brisbane offices.

Planner West had acquired a sophisticated CAD system prior to their merger with GHD, but with all staff together in the new Sydney premises in Regent Street, the more powerful facilities located there were available to all sections of the office.

The effectiveness of computer-aided design and drafting continues to become more apparent in many of the fields in which GHD is involved, and appropriate computing facilities are now located in virtually all offices of the firm throughout Australia. Engineers and draftsmen have been quick to accept the challenges posed by the new technology, and have been active in the writing of specialised programs and adaptation of existing programs for use in all aspects of the firm's work, as the computer changes the whole approach to many aspects of engineering and drafting.
In more recent years, the development of compact and versatile desktop microcomputers and the appropriate software has led GHD to install large numbers of personal computers for use by engineers and technicians in almost the same way as their predecessors used the slide-rule and later the pocket calculator. Tom Fricke in Melbourne has the overall responsibility for the hardware and software used by the firm, and the task of coordinating the ‘computer cells’ which have been established in each office to ensure that GHD staff are kept up-to-date with programs and techniques, without unnecessary duplication of effort.

Typical of the inventive talent of GHD was that of Alex McPhedran, the manager of the Hobart branch pre World War II. Alex liked to have people like him. He thrived on goodwill and bonhomie. He was apologetic to his friends and acquaintances during the frequent occasions when their water was cut off.

The practice in Tasmania at that time was to permit new connections to the water mains only during one morning each week. Newly erected houses and cottages were always a feature of the expanding city and, as applications for water services were lodged by the new householders, a water operator would isolate the section of the town or suburb in which the connections were being made. It was inconvenient to say the least and in the summer time could be quite distressing.

Alex sat down and drew the specifications for a self-inserting valve which could be screwed directly into the pipes that were in use in Hobart at the time. The theory was that the valve would shut off the water from that particular point only — that is, to the single dwelling where the water was to be connected.

The prototype valve was a success. Alex patented his invention and was able to bask in the goodwill of his clients once again. The invention was widely used in Tasmania for new connections to existing mains.

With GHD, even helicopters are just a tool of trade!

In North Queensland the rain has to be seen to be believed; at times of heavy deluge to be caught in the rain can be akin to walking under a waterfall.

Early in 1979 high in the rocky Behana Gorge, near Cairns, a severe rockslide crushed a main pipeline from one of the Cairns water supply intakes. The damage occurred at the height of the wet season; during that week, rainfall of 1355 mm was recorded in one twenty-four hour period.

Apart from the crushing of the pipeline itself, many thousands of dollars worth of damage was caused to vehicular and walking maintenance accessways. High floodwaters in the deep rocky gorge washed away sections of the embankment within which the pipeline had been buried. Repairs to the embankment involved the bringing in of all the backfilling material as well as the materials for the replacement retaining wall. The rock-filled gabion technique was selected for the construction of the retaining wall.

Galvanised wire mesh baskets were positioned onto foundations freshly cut into the rock surface of the gorge and filled with graded stone cobbles. This was the first use of this technique in the Cairns area. Heavy galvanised
bars were grouted into the rockface and arranged as tie rods, with large steel washer plates exposed on the finished wall face. The gabion walls were backed with a filter cloth, backfilled and capped with reinforced concrete pavement on top.

A helicopter was used to position the replacement steel pipes in 2.5 metre lengths, as well as equipment and material required for the construction of the walkways and walkbridges further up the gorge.

The helicopter used was a Bell Jet Ranger capable of a half tonne lift. It was chartered by the contractor, Queensland Stone Constructions Pty Ltd.

The flying was particularly hazardous and had to be done early each morning to avoid the erratic temperature gradients which can develop with direct sunlight entering the gorge.

Roger Marks was the GHD project engineer.

A final example of GHD’s resourcefulness involved the old Ghan railway line of South Australia. This romantic memento of Australian history is preserved in a new tramway between Elaroo and Proserpine, Queensland. The tramway was designed to carry cane to the mills at Proserpine, a total distance of fifty-two kilometres.

GHD used the thirty kilogram rails from the old Ghan line on a track using wooden sleepers. After a specially devised test to check anticipated performance, GHD engineers decided to use Swage-Lok fasteners (huck bolts) as an economic alternative to continuous welded rail. It was the first time in Australia that the fasteners had been used and means that the old Ghan will live on into the twenty-first century — as will many more of GHD’s unique achievements.

The relative isolation of Australia and its vast distances have required innovation by its people and GHD inventors have made their contribution. In the late 1980s Australia is facing different challenges and the engineers of GHD are involved in the application of new technology to help solve current economic problems.

As an example, when the general manager of Bulk Grains Queensland was opening the award-winning Fisherman Islands Grain Terminal in 1986, he commended GHD-Planner West for its application of new technology in providing the most cost-effective grain loading facility in Australia. This arises from the high throughput to storage ratio of 25:1 and high labour productivity.

Because of the need to make Australia’s grain handling and storage system as economical as possible, the Federal government established in 1987 a Royal Commission to enquire into this subject. GHD engineers Trevor Hazlewood and John Planner were engaged as a team to report on the implications of new technology in the handling and storage of grain.
Award-winning Fisherman Islands Grain Terminal, Brisbane.
DAMS

I drink to the bitterness of drought,

the drying pool, the dying tree,

the barren flower that cannot fruit,

the sun’s embracing anarchy.

‘Drought’
Kenneth Mackenzie
(1913-1953)

I learned to swim in the creeks of Megalong Valley in the beautiful Blue Mountains of New South Wales. The winter rains there always seemed to push a dead tree into such a position that branches, logs and coarse sand piled up around it, temporarily reducing the creek flow and, in effect, making a dam.

They were not big dams, sometimes six metres by up to twelve metres long, but rarely greater than that. We were all too poor to buy swimming costumes — there were no swimming trunks then — and we used to stand at the edge of the pools mother-naked and fall flat onto the icy water. We called that diving; it was great. I can still feel the sharp sting of the cold clear water and can still see the tangle of forest debris at the end of the dam.

Each year when we went into the valley in the summertime there were always new dams on the creeks; we never gave a thought to the fact that the old dams had been swept away. I never gave much thought either to how dams were built or maintained when I was young. It seemed to me that all one had to do was find a suitable valley with a nice stream and push stones and rocks between the valley walls to make a dam.

Well, dams are not like that and, unlike my little boyhood dams, they must remain a permanent fixture. A dam which slips or cracks will not only lose water, it can do untold damage to farming lands and towns and, of course, to people. Damage and loss of life resulting from some of the great dam failures in the past have been devastating.

Up until World War II, almost all dams in Australia, other than concrete dams, were built using rules of thumb painfully developed, as the great sciences of soil and rock mechanics were only then being discovered. In addition, it was accepted that most large dams be built by governments and other authorities, almost always by day labour. The enormous costs, the length of time involved in the design and, later, the building stage, could only be handled by an organisation with a cornucopia of money.

A problem for any public authority in designing and constructing a dam is the deployment of staff when the work is complete. Advantages were perceived in involving private consultants and contractors in the dam-building field, as their work-forces and procedures may be more flexible.
GHD has investigated, designed or supervised the construction of a
greater number of dams in Australia than probably any other Australian firm
of consulting engineers. The dams range in size from small to the ‘large’ dams
as defined by the International Commission on Large Dams. These latter dams
must be greater than fifteen metres in height or between ten and fifteen
metres, provided the length is greater than five hundred metres and embraces
at least one of the following conditions: a capacity greater than 100 000 cubic
metres, a flood discharge of not less than 2000 cumecs, especially difficult
foundations or unusual design.

In view of Australia’s widely varying and erratic rainfall — we seem to
stagger from drought to floods and back to drought — storage of water in
dams is essential. It is needed for land irrigation, for most town and city water
supplies and sometimes for very important mining and industrial purposes.
Other storages are needed for recreation, power generation, environmental
protection and as flood control measures. In some cases storages are
multipurpose.

The dam is one of the largest civil engineering structures made by man.
Because of the need to build dams on natural earth or rock foundations, and
usually from natural materials nearby, great care, skill and judgment must
be exercised by the dam engineer, drawing from his own experience and that
of others. As large dams are very costly the designer, to keep the cost as
economical as possible, should be innovative where appropriate, making the
greatest use of the lowest cost materials but bearing in mind always the safety
angle.

The most interesting aspect to me of the dams designed, supervised or
investigated by GHD in Australia has been the introduction of entirely new
features not previously used in this country. Undoubtedly the reason for
GHD’s pre-eminence in this field was the original interest, innovative
conception and enthusiasm of Geoff Davey.

The most common reason for the failure of large dams in the past has
been ‘over topping’; excess water flowing right over the top of the dam due
to the lack of adequate spillway provision. It is not easy to estimate the
maximum size of a flood, but without an accurate estimate it is impossible
to design a spillway to cope.

In 1934 Geoff Davey was the resident engineer for the rebuilding of
Cascade Dam at Derby in Tasmania, which had been destroyed by
catastrophic floods in 1929 with tragic loss of life. It had been the old story
of the spillway unable to cope with the excess water which flowed over the
top of the twenty-five metre high dam; the dam completely disintegrated.
It was rebuilt as a rockfill dam with a concrete face, probably the first such
dam in Australia, following the example of early mining dams in California.
The spillway was redesigned for the new dam, which has been in excellent
condition ever since.

However, rebuilding a failed dam influenced Davey strongly in this matter
of spillway design and this has been reflected down through GHD practice
over the years. Estimating the spillway capacity for large dam construction
is an area of specialised hydrology requiring experience and judgment.

Tom Fricke had begun his career in the Hobart office under Alan Strom, before transferring to Melbourne to develop his expertise in hydrology and hydraulics. His first major job with GHD was estimating spillway capacity for a major dam (Bungal Dam in Victoria), conducting spillway model tests, and so on. GHD has a specialist hydrology/hydraulics ‘cell’ led by Tom Fricke which uses the utmost care and the latest mathematical methods to ensure any dam will be safe from overtopping.

In 1936 Geoff Davey built another dam, a fifteen metre high concrete slab and buttress dam, in Tasmania for the Mt Paris Tin Mine. It was designed by Davey, whose innovations in the design and construction of dams were a byword in the field of consulting engineering in Australia. A slab and buttress dam, as its name suggests, consists of a series of concrete buttresses about five to six metres apart, spanned upstream by reinforced concrete beams and slabs. The upstream face slopes at 60 degrees to the horizontal.

One of the labourers on this dam, a stripling of eighteen years, was John Haskins, son of Gerald. John had left school the previous year and Gerald had sent him to the job to learn what physical labour was all about; he did, for six months. He was granted no favours, received labourer’s wages and lived in the rough housing provided for them.

The mundane matter of transport was a problem for Geoff Sparks, resident engineer on the Coombing Creek Dam, a slab and buttress dam for the Central Tablelands Water Supply (New South Wales) in the late forties. GHD had not earned a reputation for the overpayment of thier resident engineers and Geoff could not, on his salary, afford the luxury of a car. It was too far for him to walk from his accommodation to the site of two concrete reservoirs being constructed some distance from the dam site and so, being an ingenious young fellow, as all GHD engineers are encouraged to be, Geoff purchased a horse, called ‘Socks’. Socks was not stupid and reasoned to himself that, were Geoff not able to catch him in the morning, he would not have to carry the wretched fellow the eight kilometres or so to the reservoirs. The result was that a fair proportion of Sparks’ time was taken up trying to catch Socks each morning.

Sparks found that it costs money to keep a horse. He had vaguely thought that horses lived on grass alone. The cost of oats and other horsefeed, blacksmithing and so on ate into his wages more than he had anticipated. His request for reimbursement of ‘horse mileage’ almost destroyed the smooth-running accounting department of GHD. At least one could say that the lad was a trier.

Geoff took over as resident engineer of the Rocky Creek Dam at the beginning of the fifties. It was built in subtropical rainforest to supply Lismore and district and was an interesting example of Davey’s flexibility in concept. He had designed it before the war as a concrete multiple-arch dam, but by the end of the forties labour costs and material shortages influenced him to change it to an earth dam. This was bold, as earth dam science was in its infancy (soil testing had to be carried out in the laboratory of the University
of Queensland!!) and the day of the big earthmoving machine was only just dawning. Also, he put the outlet tower a mile upstream of the dam and tunnelled half a mile through a ridge for the outlet pipe from the storage, thereby saving some twenty-five kilometres of supply pipeline. David Skillington and John Murray began their long engineering careers as juniors supervising the construction of this dam.

Not infrequently it is necessary to raise the height of a dam to provide increased water storage for any number of reasons — increased population, enlargement of irrigation areas, extension of water supply to additional towns and so on. To simply build an additional wall on top of a dam already in operation could invite disaster. The pressure of water, particularly in times of full capacity, could conceivably push the newly constructed addition off the old dam wall.

In 1959 the Sooly Creek Dam (Goulburn, New South Wales) wall was raised four metres. Geoff Davey recalled that a new process had been tried overseas for the raising of dam walls. He discussed the matter in detail with Roger Smith, once more one of GHD’s engineers after two years’ experience in the United Kingdom, and asked him to develop the idea ‘and make it work on the Sooly Dam’. Roger developed the concept which finally meant the actual stitching of the newly built top portion of the wall to the bedrock on which the original dam wall had been placed. To achieve this holes were drilled right through the dam wall from top to bottom to anchor the new structure to the bedrock by using post-tensioned cables of great strength. It was the first time such a system had been used in Australia and its introduction required a lot of courage; the operation was successful.

Subsequently, the same stitching process was used when the capacity of other dams was increased, including the great Hume Dam on the River Murray, where Smith prepared the design and development for the contractor.

Later, Roger Smith designed Porter’s Creek Dam for Nowra Water Supply. It was a gravity dam, much slimmer than would be normally safe, but held down to the bedrock by stressed cables. By this innovation, GHD saved the client a considerable sum and produced a perfectly safe, good-looking dam.

In the late fifties, three dams in Queensland were a triumph for Davey, and, of course, for GHD. They were the Corella River Dam at Mary Kathleen, the Leichhardt River Dam (Lake Moondarra) at Mt Isa and a further backup dam on the East Leichhardt River for Mary Kathleen. The first two are of particular interest.

These were mining dams and there were problems which centred on the inadequacy and cost of transport, as referred to in an earlier chapter.

Davey’s experience solved the problem. He had rebuilt the rockfill Derby Dam and had read of some huge rockfill dams in California. He knew that a rockfill dam with an impervious cementitious upstream face needs relatively little cement or labour compared with an all-concrete dam. Using local materials he built the dams, sluicing the rock as it was dumped in an effort to obtain a better ‘slip’ to the rocks for compaction and so help to overcome
later settling. On the upstream face of the dam he had gangs of Italian migrant workers place small stones by hand in the chinks between the larger rocks.

The vagaries of an uncertain climate caused one very large setback to the building of the dam at Mt Isa. It is normal, when building a dam, to divert the course of the stream or river so that the dam wall may be completed before it begins its work of holding the water. An equally important reason for diverting the course of a river or stream while building a dam is to obviate the danger of a sudden flood or rush of water overtopping the dam, with the consequent danger of a breach in the wall.

The Mt Isa dam was, to say the least, a little different. First of all, the Leichhardt River does not run at all in the 'dry' season, not even the slightest trickle, and so there was no need to build a diversionary channel. Secondly, the 'wet' and the 'dry' seasons in North Queensland are so clearly defined that Davey and his engineers calculated that the dam would be complete, spillways and all, quite comfortably before the 'wet' began. It didn't quite work out that way.

John Ryan, who was assistant engineer to Dave Skillington on the dam site, recalled that a quite unseasonable cloudburst on the upper reaches of the dry Leichhardt River upset all their plans. He watched in awe as a wall of water two metres high rushed down the dry river bed and struck the partially-built dam wall with tremendous force. The water rose quickly, overtopped the dam and breached it. Much of the dam wall of rock finished up kilometres downstream. When the water had gone by, the river bed was as hard as flint again and the rebuilding of the dam wall commenced.

When the faces of the dams on the Leichhardt and the Corella Rivers had been virtually built as sloping stone walls and covered with mesh, Davey pressure-sprayed the whole with cement mortar ('gunite') and produced a mortar cover 7.5 to 10 centimetres thick. The dams, twenty-seven and twenty-three metres high respectively, hold water and their cost was minimised. The use of gunite on these dams was believed to have been the first time such a practice was used.

David Skillington was resident engineer on the job and later talked of the extreme discomfort there — heat, flies, no amenities whatsoever, indifferent food and tent accommodation. The resident engineer on a dam site may often live there for up to three years in conditions far different from his normal home atmosphere.

In the investigation of the Wenlock River Dam site at Wenlock in North Queensland, wild pigs were a menace to the team of engineers and surveyors and, not infrequently, the safest place for a surveyor was up a tree until a grunting boar moved elsewhere.

Tasmania saw a remarkable development in Australia in dam design with the construction of the thirty-six metre high Risdon Brook Dam, completed in 1967. It was designed in 1964 as a rockfill dam which would be sealed on the upstream side of the dam wall with a thin concrete face, but with an important difference. Rockfill dams were not a new concept, quite old in fact. They were built by dumping truckloads of rockfill down steep slopes to crash
into place at the bottom, all the time being sluiced with water jets. They were prone to cracking due to the rockfill ‘settling’ with time and the water load, with consequent leakage of the precious water. Risdon Brook was to store hard-won water that had been pumped fifty kilometres; leakage was unacceptable.

Alan Strom, the Tasmanian partner at that time, had read of the building of a rockfill dam, the Quoich Dam in Scotland, where layers of rock somewhat less than one metre thick was compacted with a vibrating roller weighing up to seven tonnes. It was claimed that it did not settle or leak. Dave Skillington (then his second-in-charge), who was on a world tour, visited Scotland and inspected the dam, and found this to be indeed the case; he confirmed his findings to Strom by telegram. Strom tried it at Risdon Brook and set a new method on way in Australia for dams of this type. The dam has not settled, the concrete facing has never cracked and the dam hasn’t leaked to this day.

One unusual dam worthy of mention is the Dangera Creek Dam, completed in 1971 as a water supply storage for Nowra (New South Wales). It was found from the geological excavations that a normal slab and buttress dam was not entirely suitable. Roger Smith took over this project from Davey upon his retirement and, following GHD’s policy of breaking new fields where required, introduced a new design in Australian dam building to cope with the difficult problems of this particular site.

The new dam was a diamond-head mass concrete gravity buttress design thirty-six metres high. The diamonds faced upstream and contained the water between the buttresses, as against the normal and acceptable clear wall of a slab and buttress dam. It is thus like a slab and buttress dam but built of the very much less costly mass concrete, or it could be looked upon as a traditional mass concrete gravity dam hollowed out to save foundation costs.

The late Mal Robson made a substantial contribution to the design of
GHD dams, including Curries River Dam in Tasmania and Spencer Dam near Mackay; his untimely death was much regretted by his colleagues. Alan Strom recalled a unique ability that Mal had, in that when they would return the one hundred and forty-five kilometres to Mackay from a day exploring the dam site, Strom, who rather fancied himself in doing The Australian cryptic crossword, would shout the clues to Mal who would be driving. Back would come the instantaneous answers, to Strom’s amazed mortification. Driving with the car’s internal lights on was usually necessary to get the puzzle completed.

John Phillips, of GHD’s Perth office, has been associated with some of the firm’s more unusual dams.

Reynolds Metal Company wanted to use the headwaters of the Augusta River for the processing of bauxite at the proposed Worsley Alumina Refinery which is situated in a worked-out jarrah forest in the Darling Ranges. It was a delicate situation. The proposed site was about sixty kilometres from the coast, half-way between the bauxite mine at Boddington and port facilities at Bunbury. The country through which the river flowed was quite scenic.

The environmental dangers were very real. An alumina refinery produces large quantities of process residue containing caustic soda, as well as lesser quantities of various liquid wastes. It was essential, therefore, to isolate and trap all waste residues at the source, preventing them from entering the river system with consequent danger of environmental destruction.

‘Could pure water be provided and could wastes be prevented from polluting the beautiful river and its environs?’ asked Reynolds. It could. Alan Strom as project director, with Tom Fricke and John Phillips, presented a feasibility study confirming this and the appropriate State government departments supported this view. Ken James, a prewar Gutteridge engineer and now a retired Air Commodore, returned to take charge of the complex field investigations to determine foundation conditions for the dams. John Phillips led a team including David Brett and Dr Glen Truscott which designed the four dams required together with the appropriate water-related ancillary projects.

The dams are up and the refinery is in operation. The problem of the storage and control of the vast quantity of red mud which flows from the process has been given particular attention by GHD. John Phillips travelled overseas to inspect treatment of waste at refineries and subsequently applied for patents for a quite revolutionary treatment of refinery waste. The new treatment reduces the storage space for waste and allows some of it to be used to advantage.

The total water management system for the Worsley Alumina Refinery won for GHD-Dwyer both the Institution of Engineers Western Australian Engineering Excellence Award 1983 and the Association of Consulting Engineers Australia Engineering Merit Award, 1984.

Another of Phillips’ dams was the Opalnia Dam, built in Western Australia for the Mt Newman Mining Company, situated on the fringe of the Pilbara. This is an unusual dam, commencing with its name which in my
dictionary is described as ‘inflammation of the eye’! The Ophalmia Dam is perhaps the only dam in Australia whose owners prefer it empty rather than see it continue to hold water.

The great Mt Newman Mining Company draws its waters for the mine at Mt Whaleback and the town of Newman, four hundred kilometres from the Western Australian coast, from underground aquifers. The lowering of the watertables, with some bores drying up altogether, pinpointed the fact that the company was drawing more water than was being replaced by natural percolation. Ground water engineers calculated that the supplies of water would disappear in as short a time as six years.

The Mt Newman area has a minimal rainfall but cyclones crossing from the coast sometimes change to rain depressions, reaching as far as Mt Newman, and dump their water in a deluge of rain over what could be called a catchment area of four thousand square kilometres. The cyclones do not appear on an annual basis — sometimes there may be three years or more between them. When a cyclone dumps its water in that area, however, the volume could be millions of tonnes of water which normally would disappear within a few days.

The concept was to build a series of dams across the almost flat terrain, impound the water and empty it into the underground storage beds before the heat of the sun took it in evaporation. Evaporation in that area is approximately three metres (ten feet on the imperial scale) per year.

John Phillips and a small team including Tom Fricke and Hugh Smirk finished their dams — three major and three minor embankments. The maximum height of the walls was about seventeen metres and to traverse the dams, including spillways and several small hills, is to cover ten and a half kilometres — quite a structure!

 Providentially, the first rain arrived just after the dams were constructed in 1982; it filled the dams. One third of the water seeped underground through recharge areas, one third was pumped directly into the underground storage system and, of course, evaporation took one third.

Special precautions were taken to ensure that the walls of this strange dam complex will not crack during the months or years in which it will be dry.

The town population of Mt Newman had been dwelling on the moment when the rain would arrive, and when it did they rushed to the water in everything that would float. The rush turned just as quickly the other way when it was found that the floodwaters had flushed out countless snakes, taipans mainly, which preferred to leave their floating driftwood for the apparent safety offered by the rafts and dinghies. The amateur yachtsmen and oarsmen retired in defeat.

At Tennant Creek in the Northern Territory, GHD designed perhaps one of the few dams ever built in Australia for purely recreational purposes. It was at the time of incorporation of the Northern Territory into independent government and the Federal government was listening sympathetically to any reasonable request to ‘upgrade’ the status or standing of the new government. The councillors of Tennant Creek and their newly elected
representative (a local resident) in the Territory Legislature opted for a dam. Following a feasibility study of the site of the proposed dam, John Phillips addressed the councillors in a tin shed doubling as a town hall.

Tennant Creek is so dry that it is said that the locals keep their mouths shut to prevent evaporation of their saliva. Perhaps that’s only a story, but the arid country is eyeball-bursting where the heat waves bounce and dance across the waterless terrain.

Phillips explained that, due to the almost non-existent rainfall for most of the year and the irregular volume of water in the ‘wet’ season, coupled with the unbelievable evaporation of three metres per year, there could be no guarantee that the dam would hold permanent water. The councillors were not even ruffled. ‘Mr. Phillips,’ said the Chairman, ‘when one has no water any of the time a little water is welcome whether it be permanent or not; we will have the dam.’

Once again, Phillips led his little team comprising Tom Fricke and Rob Taber and the dam was completed. As in the case of the Ophthalmia Dam, the ‘wet’ arrived in time and filled it. The town population and families from the surrounding districts were delighted to see the expanse of water, even though they knew that evaporation would soon take some of it away. It was a great day. The dam brought a new flavour of life to the people of a town which is subject to one of the most rigorous climates in Australia.

The size of dams built or designed by GHD varies from the official definition of the large dam to tiny dams for specific purposes. For example, GHD built a small dam for the Killara Golf Club to store sufficient water to maintain the course at the desired standard! Farmers, golf clubs, industries, town councils — all have wanted small dams for various purposes. While the scale and costs are much smaller, of course, many of the same decisions have to be made as for a large dam to arrive at the type least costly yet safe.
Repairing privately-owned dams which have failed has also been an interesting sideline, the dealings with grazier owners being somewhat easier than usual because the client is often somewhat chastened and more prepared to listen to advice.

Ben Fink recalled the building of a small storage dam across a gully for a little community in central Victoria, when his Saturday afternoon was interrupted by a telephone call from the contractor with a fairly simple question: ‘There is water flowing out the downstream face of the dam. Does it matter?’ Several testholes later the cause of the trouble was discovered. It transpired that the contractor, before closing the outlet pipe, had cleaned out the silt using plumber’s pipe-cleaning gear. In the course of this several of the pipe sealing rubber rings had appeared, but he had forgotten to tell anyone!

GHD, because of its unique experience in dam building in Australia, has been a staunch supporter of ANCOLD, the Australian National Commission on Large Dams, an esoteric club of dam designers and builders. Davey was well-known and respected therein.

Every two years the worldwide body on dams, the International Commission on Large Dams, or ICOLD, meets in varying locations. The conference is important; papers are presented, innovations discussed and inspections made of ‘large’ dams in the proximity of the conference. Davey was a frequent attender. The cost of sending a delegate to the conference is quite high, and ANCOLD sometimes asks any appropriate member who may be overseas at the time of the conference to represent ANCOLD there.

In 1971 the ICOLD conference was in southern Europe. The then president of ANCOLD asked the Reverend Geoff Davey, studying for the Catholic priesthood in Rome at the Pontificial Beda College, if he would attend as the representative of Australia? He would. Would his superiors permit him to attend? They were delighted to do so.

Geoff Davey turned up at the conference in his clerical clothes and, as usual, entranced his listeners with his anecdotes and his knowledge of large dams. It was the first and only time a seminarist represented Australia at a Large Dams Conference.

The designing of dams, the site feasibility studies, the detailed geological mapping of both the site and the potential materials areas, the hydrological assessment and the hundred and one other technical and environmental requirements would fill books, but this is not the place to note them.

However, I had the pleasure of inspecting and marvelling at features of the Bungal Dam in Victoria. GHD was commissioned in September 1968 by the West Moorabool Water Board to investigate all aspects for a major dam to supply Geelong and Ballarat. The dam, which was rockfill with an earthen core, was forty-five metres high. It was completed in June 1972 within the allotted time and within the original estimated cost.

I sat on the dam wall with Alan Strom, who had been the project engineer for the dam. I walked under the vast lake of water through 2.5 metre pipes and climbed to the top of the outlet tower. I stood at the bottom of the
spillway; it was like a smooth mountain in itself. GHD’s resident engineer, John Phillips, remained on the job until it was completed. He worked well with the principal contractor, Roche Bros Pty Ltd, and his close supervision of the project coupled with the cost-conscious control always followed by GHD was a major factor in contributing to the overall success of the project. Also, the almost total lack of industrial unrest was of paramount importance in bringing the final job to completion within budget.

One wonders what we would do in our arid country were not our precious water placed in storage such as Bugal Dam. Water is almost life itself and the preservation of the environment there, where wallabies abound and the birds flash, makes the area a haven of peace. In 1972 the project received a Merit Award from the Association of Consulting Engineers Australia.

In November 1984 GHD completed the first roller-compacted concrete dam in Australia. It was only the second in the world to be built by this method. The dam, the Copperfield River Gorge Dam, was built at Kidston, North Queensland, and is part of the massive Kidston Gold Project.
Initially, a clay-core rockfill structure was planned, but in mid-1982 the project was postponed. In 1983 GHD was recommissioned to design and document the dam to store water from the 1984-85 ‘wet’ season. The terms of the contract required the dam to be finished in less than twelve months. It was accepted that only a concrete structure could ensure completion within such a short time.

The answer appeared to be in the construction of a roller-compactcd concrete dam and a team from GHD, Kidston Gold Mines, Hornibrooks (contractors for the dam) and the Queensland Water Resources Commission visited the Willow Creek Dam in the United States to view the first of such dams to be built. The dam had been designed by the Corps of Engineers and was considered a success; approximately 340 000 cubic metres of concrete had been placed in six months!

The team discussed with the Corps of Engineers the various methods of construction of this unique step forward in engineering thought. With no time to spare the work began with foundation investigations being carried out by GHD-Wood Geotechnical, while trial mix designs for roller-compactcd concrete, using aggregate from the site, were carried out at the Queensland Institute of Technology under the direction of GHD.

The dam was completed within the contract time, a structure of forty metres in height and designed to discharge up to 5000 cumecs over the spillway crest. Project director of the dam was Henry Adcock, project manager Brian Forbes, and design engineers Ron Owen, Hugh Smirk and Russell Hoskin. Russell Dodt was the resident engineer.

GHD was awarded a Merit Award by the Concrete Institute of Australia, in 1985, for the engineering of the Copperfield River Gorge Dam.

Following the successful use of roller compacted concrete (RCC) at Copperfield, GHD designed the Craigbourne Dam in Tasmania (completed 1986) and Bucca Weir in Queensland (completed 1987).

Craigbourne Dam was constructed for the State Rivers and Water Supply Commission to provide water for irrigation. It is a twenty-four metre high gravity dam with the main spillway constructed through a natural saddle. Brian Forbes provided advice on the RCC aspects to GHD’s Hobart office who were responsible for the design. David Brett was project manager and David Skillington responsible principal. Although alternative rockfill designs were offered to tenderers all tenders received were for the RCC design, confirming that RCC was the economical solution to this problem.

Bucca Weir was constructed for irrigation purposes by the Queensland Water Resources Commission as part of the Bundaberg Irrigation Area. The weir is twelve metres high, the central section being a gravity weir with the wing walls being earthfill, protected from scour by a facing of RCC placed against the earthfill slope. The weir has been designed to be raised at a future date by the addition of an inflatable rubber dam to the crest of the RCC section. The cut-off through the earth wing walls and silt banks of the river, on which the wing walls are founded, is a cement-bentonite-filled slurry trench, extending down twenty-three metres through the river banks onto bedrock.
This is an unusual form of cut-off, being GHD's first of this type and only the third known at the time it was constructed.

Always there will be unusual problems in designing and building dams. Consequently new approaches entirely or at least deviations from past practices will be required. GHD will never hesitate to explore alternatives when the circumstances warrant it.
Hurrah for the storm-clouds sweeping

Hurrah for the driving rain!
The dull earth out of her sleeping
Is awakened to life again.
There are mirrors of crystal shining
Whenever the cloud-rack breaks,
And grass-clad banks are twining
A wreath for the fairy lakes —
Lakes that are links in an endless chain
For the water is out in the swamps again!

‘The Filling of the Swamps’
Will Ogilvie (1869 - 1963)

I enjoy a glass of clear cold water. It’s a luxury to me and my attitude stems from a long time ago when, for nearly a year, to drink unboiled water meant almost certain death from one of the most frightening diseases on earth — cholera.

By the year 2000 most Australians may have come around to my view on water, because by that time our supplies may be too small to use or rather, to waste in the fashion we always have. In our arid land we have wasted and continue to waste water and we generally put our heads in the sand when someone brings up the fact that we must one day run out of drinking water if we continue to use it as we do now.

Australia is not the only country with this problem. The Arabian countries and California are two which come readily to mind; both areas are spending millions of dollars on research involving conservation, purification and reclamation of water. At least, in Australia, we have rivers to work on. In Arabia, a huge country, there is not one permanent river.

GHD has been involved with water for more than fifty years and has worked in every State of Australia and overseas on various projects in this important field.

A. Gordon Gutteridge began specialising in wastewater collection, purification and disposal as far back as 1928. He was involved in the development of an activated sludge purification plant at Glenelg for the City of Adelaide, South Australia. It was one of the earliest activated sludge plants in Australia.
Haskins and Davey were also heavily involved in basic water problems. From their interest in the provision of engineering services for these early schemes, GHD has continued to expand through the development of every form of water supply — water treatment, water distribution, wastewater collection, purification and disposal systems in all parts of Australia and in neighbouring countries.

In the early seventies the growing community awareness of pollution and its effects, and the rapidly increasing complexity of methods to understand and combat it, led Ben Fink and Alan Strom to set up an expertise ‘cell’ in all aspects of water quality control. It was established in the Melbourne office, with links to all major offices in other States. Chemical engineers were appointed who could readily understand the problems and interpret the new processes for the civil engineers who designed or operated the treatment plants for the water and sewerage schemes throughout Australia.

Thus was born GHD’s Water Technology Cell, the first of GHD’s ‘Expert Divisions’. A few experts working as a group studied both in Australia and abroad to keep abreast of the latest developments in water technology, so GHD could maintain its position as leader in the theory and practice of water quality management. The work initiated by Fink and Strom is now carried on by Jonathan Crockett.

The research for technical excellence included gaining opinions of international experts such as Professor Bill Williams of Adelaide University, Professor Hillel Shival of the Hebrew University, Israel, and Professor von der Emde of the Technical University of Vienna. The latter has been a consultant to GHD since 1976 in all matters connected with activated sludge treatment. Through his advice GHD has developed many economic and new (to Australia) techniques such as the Usrael respirometer to accurately control the amount of aeration of the extended aeration ditch at Bundamba, Queensland, or the biological phosphorous removal at Penrith, New South Wales, or biological nitrogen removal in activated sludge generally.

The division has studied the economical lagoon method of wastewater treatment throughout Australia from Darwin to Tasmania. It has developed a thorough understanding of industrial processes, problems and treatment.

In 1976 GHD carried out for the Federal government a bench mark study into sewage and possible uses of sewage as a resource, followed by further studies for the Victorian government into planning for such re-use. In 1983 GHD finished a report forming part of the Australian government’s ‘Water to the Year 2000’ which reviewed re-use and all treatments of wastewater and drinking water.

The River Murray is Australia’s most important inland waterway. It flows for two thousand kilometres through three States, carrying the irrigation water throughout spring and summer from the great dams in the high country to the thousands of farms which produce so much of Australia’s food. It is the source of fresh drinking water for many farms and towns and the City of Adelaide.

In 1973, the Australian government proposed Albury-Wodonga, situated
in two States below Lake Hume, as an accelerated growth centre, to be increased in population from 55,000 to 300,000 by the year 2000. What would be the effect of such a large population increase on the River Murray? To answer this GHD was appointed to carry out a major study into all features relevant to long-term planning of sewerage and drainage that would ensure the Murray water was not degraded.

The best indication of the health of the waters of a river is the status of the living creatures in it, particularly the microscopic plants or algae and the tiny invertebrate animals.

In view of the importance of the project, GHD asked Professor Bill Williams to design this part of the study, and thus began a long and continuing collaboration between Australia’s leading limnologist (fresh water biologist) and GHD. Bill laid down that there must be a baseline study in which the complex system of lakes, rivers, anabranches and tributaries of the Albury-Wodonga district would be periodically sampled and the samples thoroughly tested, chemically and biologically. These were mostly tested in a laboratory which EML (GHD’s associated chemical laboratory) set up in an old army hut just out of Wodonga. Bill enlisted his colleagues, Dr Keith Walker, biologist, of Adelaide and Dr Peter Tyler, algologist, of Hobart, to form with him a scientific control and review panel for the study which was carried out by a bright young biologist, Roger Croomer. Dr Barry Hart of Melbourne carried out the chemical and water quality overview. The study necessarily ran for only nine months before the report had to be presented, and thus there was a period of intense work by Peter Hallows and Alan Strom in organising the study and writing the report, the three volumes of which became a text book.

Overseas advice was obtained from Dr John Alabester of the Water Research Centre in the United Kingdom and from Dr Clair Sawyer of the United States. Sawyer advised on the (then) latest techniques for sewage treatment, particularly in regard to removal of nutrients from the effluent. Nutrients are the chemical essential for the growth of plants and, in the study context particularly, the growth or overgrowth of the minute algae.

It was quickly established that one of the most significant effects of the growth of Albury-Wodonga could be to increase greatly the amount of nutrients, essentially phosphorus and nitrogen compounds, and that this could result in over enrichment (eutrophication) of still or slow-moving water bodies downstream, and thus a ‘bloom’ or overgrowth of algae with resultant smelly and slimy degradation of the waters. Sawyer was a particularly apt choice for nutrient removal advice in that she had been the first to point out the effects of phosphorus on American lakes some fifteen years before. ‘Doctor Eutrophication’, she was termed by Strom.

The final report advised that sewage, after a high standard of treatment, should be taken to a large, specially designed farm where crops and trees would be grown, thus ensuring complete removal of the nutrients, hydrocarbons and viruses before being returned to the River Murray. It also found that likely nutrient effects would dictate their removal when the
population reached about 100 000. Another recommendation of the report which was followed by the Albury-Wodonga Development Corporation was that the monitoring study of the waters should continue, largely to afford a long-term and more complete data bank which would protect the Albury-Wodonga development against ill-informed attack from other interested parties. In this it has been very successful.

In this area the River Murray is, of course, in New South Wales, the border with Victoria being the left (southernmost) bank. As part of the study, the incidence of pesticides in the waters was of great interest. These, if present at all, are in such minute quantities as to be close to the detection limit of the analytical machines available. Thus, freshwater mussels were put in wooden cages at selected stations; these mussels concentrate pesticides and heavy metals and so serve to facilitate detection and measurement. Also, to complete the study, fish were taken and sampled, although being so mobile they were not of great significance to the study. GHD was a little taken aback to receive a letter from a New South Wales government department advising that, in taking fish and oysters (the mussels) from the waters of New South Wales without a permit, GHD had infringed a certain subsection of such and such Act, for which the penalty was so and so.

Perturbed at such institutional paranoia, GHD consulted its advisers and in reply informed the department that the fish were taken only from anabranches inside the Victorian border and the mussels were, in fact, Victorian citizens by birth, having been taken from a farm dam in Victoria, and thus were only temporary residents of New South Wales. The correspondence lapsed.

However, one of the main things to come out of this milestone study for Australia was the development of the relationship between the engineers and the scientists; each discovered that the other had valid points and so any suspicions borne of ignorance disappeared. The team of GHD/Williams went on to many other major investigations, including the establishment of the State Environment Protection Policies for the Western District Lakes in Victoria; the viability of a major recreational lake for the proposed city of Monarto in South Australia; the detailed nature of sewage and the possibilities for its use as a resource in Australia; the ‘water’ wisdom of further large-scale lake and canal development behind the Queensland Gold Coast; the protection of Lake Burley Griffin, Canberra, and various water reservoir investigations.

In 1985 GHD, with the assistance of agricultural consultants, ACIL Australia Pty Ltd, carried out a study of waterlogging and salinisation in irrigated areas of New South Wales. They reviewed the cause, extent and severity of both problems which in 1985 had affected some 200 000 hectares of farming land in the State, with a loss of $5 million to the community. The study identified a number of measures that could control, if not prevent, both waterlogging and salinisation. It made recommendations for more research, more education of the public and a maximum involvement by the irrigation community.
Leading the study team were Warwick Keirnan of GHD's Sydney office and Peter Hallows of the Melbourne office. Both engineers were gratified when the study received a High Commendation in the 1985 Engineering Awards Competition of the Association of Consulting Engineers Australia.

Back to our glass of clear drinkable water — we do not always have this benefit in Australia unless action has been taken to make it so. The storage area for drinking water may often mitigate against its purity. The water may be muddy or turbid with suspended clay or perhaps it may be discoloured by humic acids from vegetation. Sometimes a storage area will grow blooms of algae which can cause odours and tastes in the water, and in ground water there may be iron and manganese which can stain clothing, or the water may be excessively hard.

GHD has built about fifty water treatment plants of every conceivable type all over Australia and in Bougainville and Malaysia. That would not be very impressive as a simple statement but what is worthy of thought is that most of the methods of treatment have been devised by the GHD team, who have adapted many overseas developments to local conditions and thus pioneered a number of improvements in water treatment in Australia.

When in 1943 GHD built a small treatment plant in Tasmania to treat highly coloured water, it was found that the water flowed over what is known in that beautiful little island as 'button grass' country. The 'button grass is ecologically unique but also has the distressing feature of turning water into an unsavoury brown liquid, harmless and drinkable but certainly not to be enjoyed. It is very difficult to clear by conventional water treatment, which involves combining the colour with hydroxide (alum) and allowing the floc to settle!

Alan Strom, a director interested in almost everything to do with water, from its storage through to first purification and later reclamation, was given the task of solving this particular problem. He worked with Bunny Gray, a chemist employed by the Beaconsfield Shire Council to operate the plant. Gray had been 'cyaniding' the vast mine tailings there for gold and when these had cut out he had joined the council staff rather than leave the beautiful area.

Strom and Gray developed the use of a little-known chemical, activated silica, for the first time in Australia; it assisted the alum in its clarification work and stabilised the plant's operations. To the long-suffering Beaconsfield residents it was like winning a lottery prize. The treatment has since been modified and improved but the daily monitoring of that water supply results in pure drinking water.

The use of activated silica as a floculant where necessary to improve operation and water quality was subsequently adopted by GHD at nearly a dozen treatment plants, in many cases years before flocculants were used by others in Australia. The large Hobart water treatment plant built in 1963 was a particular example of effective treatment, the clarifier there producing water continuously clearer than any other plant in Australia at that time or most since.
The GHD team of water enthusiasts is spread throughout Australia. Bob Macintosh, who joined GHD in 1962 after working in the Northern Territory, South Africa and Zimbabwe (then Rhodesia), became the water supply and water treatment expert of GHD in Queensland and the Northern Territory. From 1962 he was responsible for major water supply projects for cities and towns, rural areas and new mining ventures throughout Queensland, the Northern Territory and New South Wales. In his work with the Rous County Council (a water supply authority centred in Lismore in northern New South Wales) he was following in the footsteps of Geoff Davey. It was in the late 1940s that Davey engineered the Rocky Creek Dam, which water system has now expanded to cover surrounding rural areas and coastal towns. In 1973 Macintosh became a director of GHD.

John Ryan of Queensland was another of the GHD team of water enthusiasts. He was engaged by Davey in 1956 and had wide experience in Queensland and the Northern Territory, after working in England and the Middle East. In Brisbane John was made responsible for sewerage and wastewater treatment. In the late 1970s and early 1980s he designed new or augmented wastewater treatment plants for cities such as Ipswich, Bundaberg, Gold Coast and Redcliffe. When he became a principal of GHD John had probably served the firm in more locations than most of its staff.

Ken Hartley is principal engineer (water and wastewater treatment) in Queensland and has been responsible for the process design of many of the treatment plants designed in Brisbane office in recent years.

In 1985 he thought that his technical knowledge and years of experience in the field of wastewater treatment could be of assistance to a wider audience, and wrote a book entitled ‘Operating the Activated Sludge Process’. Publication of the book was underwritten by GHD. It has sold well, particularly in the United States where there are many plants using this process, and is now in its second printing. The book is written for use by engineers and operators of treatment plants and is possibly the only textbook in the world written on the practical aspects of this subject.

Don Cameron in Tasmania was another who worked throughout Australia and overseas ensuring that the water people use is fit to drink and the treatment process used is the most economical to build and run.

GHD introduced several processes to Australia: tubesettlers for high rate sedimentation on confined sites first used at Toowoomba, Queensland; self-backwashing filters, first used at Dubbo in New South Wales; and direct-filtration used in a major plant at Albury, New South Wales.

Today GHD sees a growing trend towards lower-cost, no-frills water treatment plants that are economical yet will still give sufficient treatment of our many substandard town water supplies so as to provide that most precious of all commodities — a glass of pure, clear drinking water.
**CONQUERING THE DISTANCE**

_The mountain road goes up and down_

_{From Gundagai to Tumut Town._}

_And, branching off, there runs a track_

_Across the foothills grim and black,_

_Across the plains and ranges grey_

_To Sydney city far away._

_"The Road to Gundagai"_

_A.B. Paterson (1864-1941)_

In half a century of service to the development of transport in Australia GHD has been part of a continuing revolution. Prior to World War II Bernard Callinan drove his T-Model Ford, the second of a fleet of two cars used by GHD. The number one car in the fleet was the famous Rolls Royce driven by Gutteridge, but by today's standards the transport and facilities available then were quite primitive.

Roads, bridges, railways and airports have, of necessity, been updated year by year in a frantic effort to keep pace with greater demands on their services.

Roads in Australia are a problem in every way compared to, say, European countries from where the majority of our people came. Our country embraces every conceivable type of terrain from gibber plains to jungle, from desert to flood country, from unstable hillsides to mine subsidence areas and, of course, there is so much of it. We do not have sufficient taxpayers to pay for what we would always like to have and consequently road engineers are called upon very often to make the best of what they can with local materials.

GHD has surveyed, designed and supervised the construction of some of the most difficult and inaccessible roads in Australia, in addition to designing urban and main roads where even temporary dislocation of the traffic flow can cause huge problems. GHD engineers give a complete service for roads and their ancillary requirements such as culverts, bridges and earthworks. For fifty years they have undertaken route planning and location, preliminary design and economic analysis to determine a preferred route.

Some of the more spectacular road designs by GHD engineers took place in North Queensland and the Northern Territory. Roads in those States struck through the lonely country to provide not only reasonable access but an outlet from those areas for the transport of beef cattle to the coast. The engineers overcame not only the difficulties engendered by the remoteness of many of
those roads but the necessity in many cases of prospecting for local materials with which to build them.

The building of roads often has political overtones which the engineers and road builders could generally do without. However when the High Court decision was made validating the decision to stop construction on the Gordon-below-Franklin Hydro Power Scheme in south-west Tasmania the Federal government had to provide alternative construction projects to alleviate some of the unemployment resulting from the cessation of work on the hydro scheme. Road construction was an obvious area of need which could provide employment for some of the displaced workers.

The Tasmanian Department of Main Roads asked GHD to design and survey a tourist road linking Cradle Mountain Road in the east to the Murchison Highway in the west. The proposed route, a distance of twenty-six kilometres, was from eight hundred to one thousand metres above sea level and crossed the rugged Black Bluff Range. The first four kilometres had to be ready for construction within six weeks and the complete design of road within twenty weeks.

The assignment was a challenge. There was an absence of mapping suitable for even a preliminary design so the photogrammetry section of GHD's Melbourne office began work immediately. The team produced 1:5000 maps in just seven days after receiving the commission and one week later two survey teams were in the field. The surveys were conducted in myrtle forests and swamps in bitter weather of almost continual rain and snow. To overcome the difficulty of movement in the rugged terrain, a specialised track vehicle, originally developed for use as a troop carrier in the Vietnam War, was used daily to ferry surveyors and others to the work sites.

Immediately the maps had been received from the photogrammetry section the design engineers and the landscape designers went into action, prepared approximate route locations and completed details of horizontal alignment. The road was designed to comply with vehicle speeds of eighty to one hundred kilometres per hour through virgin highland country, some of which is so scenically sensitive that careful attention to the landscape was necessary.

The total survey and design of the Cradle Mountain Road was successfully completed on time. Project director was Dave Skillington of Hobart, project manager was Alan Thompson and the design engineer, Colin Mews of the Melbourne office.

The important aspects of environmental impact are always identified in consultation with both the client and the various statutory bodies which lay down guidelines on this subject. GHD uses modern in-house computer facilities as an aid to design and drafting.

GHD has brought a forward-looking approach to road making in all States and its consultant engineers specialising in the design of roads will continue to be innovative as they meet new road building problems. The company's clients in the road-building field in Australia include Federal, State and Territory road authorities, local authorities, mining and pastoral companies,
State utilities and private clients including land developers.

The special needs of this wide cross-section of clients has required the application of varying design standards applicable to developmental and tourist roads, rural highways, urban arterial roads and freeways. It follows that every road project becomes an exciting challenge requiring, perhaps, a completely different approach to a previous job.

In the design and/or supervision of construction of over 3800 kilometres of rural highways and developmental roads, GHD has introduced new features of road building as the necessity arose.

Its engineers adopted reinforced earth retaining walls for the first time in Australia. They have also used support fabric and pre-loading techniques in swampy ground conditions. They have designed heavy duty pavements incorporating concrete, asphalt and soil stabilisation to withstand heavy wheel-loads from off-highway mine haul vehicles and to minimise maintenance under high traffic volume.

Urban arterial roads, urban roads and streets carry special problems. By 1985 GHD had designed or supervised three hundred kilometres of them. Local councils have different standards and environmental aspects are high on the list. One of the problems in urban road provision has been that many roads and junctions were not designed to cope with the number of vehicles on the roads today. Bypasses and interchanges make a lot of sense in areas where the roads are unable to cope adequately with a large volume of traffic.

The Granard Road Interchange on Ipswich Road was planned to be one of Brisbane’s largest urban arterial road interchanges. This multi-million dollar project was designed by GHD Brisbane for the Main Roads Department of Queensland using the MOSS (Modelling Systems) Computer Program.

In 1974 the entire area of the interchange was inundated by the flooding of the Brisbane River. Consequently the design provided for the Ipswich Road carriageways and the four ramps leading to Granard Road to be constructed on raised embankments which would be higher than the fifty-year flood level. The interchange includes three bridges with fills up to twelve metres high. The construction of this massive interchange was planned to be completed in stages; the design has provided for projected traffic flows to the year 2000.

Job manager for the interchange was Peter Rudd, principal road design engineer was Lincoln Davis, while Chris Baker was responsible for civil and drainage design.

It is no longer acceptable to design roads on old standards. Planning of townships or subdivision of areas for residential purposes requires complete design to cover all the amenities and the traffic density so as to adequately service the proposed areas.

Although it is normal practice now to include shopping malls in new subdivisions, many established cities and towns have opted to produce malls and places by blocking off streets and diverting traffic to other areas. It is a satisfying project to design a mall which will include pleasant surroundings for shoppers and travellers and, in effect, provide an oasis within a town or city.
The City Fathers of Cairns opted for a large ‘Place’ within the city. It provides an area for public enjoyment and relaxation in addition to shopping amenities. The Place includes extensive landscaped areas reflecting the lush tropical picture of the city, shade structures and seating facilities, and provision for open stage performances. GHD assisted the staff of the Cairns City Council by preparing submissions regarding the impact of the Place on nearby business, traffic and parking, and a summary report which included the landscape architectural concept.

The landscape design submission was developed following presentation of alternative designs to the Council. A model of the final concept was made in Cairns and received widespread and favourable publicity throughout Queensland. Tony Lewis from Melbourne office assisted with the preparation of the landscape architectural submissions and Matt Francki from Sydney office provided traffic engineering. Ursula Kerr of Cairns office was GHD job manager and planner.

GHD has developed subdivisions in five States, providing for approximately 60 000 residential allotments. In Bougainville, Papua New Guinea, twelve kilometres of roads were designed for the townships of Arawa and Panguna.

A road of any length usually crosses a culvert or a bridge, or both, or many of both, so GHD engineers have always been involved with bridges, at least three hundred of them. Some of these structures have been minor, but some quite long — one was over one thousand metres in length! The bridges have carried and continue to carry road, rail and pedestrian traffic. They have been built in impossible places all over Australia and overseas. There appears to be no end to the type of bridge or the resourcefulness of GHD’s engineers. They have met every conceivable type of problem with determination and new concepts.

The Mackenzie River bridge on the Gregory railway in Queensland is one of more than 50 railway bridges for mining developments designed by GHD. This 440 m bridge has 18 pre-stressed concrete spans.
In 1953 they were associated with one of the first prestressed concrete bridges in Australia; it was an overbridge to the munitions plant at St Mary's, New South Wales.

They have specialised in the railway overpass and have worked with some councils on bridge construction, Penrith City Council for example, for many years.

One bridge over the Etheridge River in Queensland was designed to cross the river as any respectable bridge should do, and was situated 'under' the river in flood periods. It was once submerged five metres below the flood height but was not damaged; it had been built to withstand such punishment. The Etheridge River Bridge, one of fifty designed by GHD for the far north of Queensland, is so remote from industrial manufacturing and transport facilities that the 18.4 metre span prestressed concrete beams were manufactured on site.

A number of bridges have been built in central and north Queensland, where bridges have to be designed in many cases to withstand submergence. The thought of a bridge under the water instead of above seems to be quite topsy-turvy, but not to the engineers. It was explained to me that the bridges are necessary but the amount of traffic carried by some is quite sparse. Floodwaters in many of the areas have a disconcerting habit of covering the roads and plains for miles around and rendering movement impossible. The building of a high-level bridge would have the effect of placing the bridge above the floodwaters but still sitting in isolation and unusable.

Some of the engineers have their favourite bridges, one such being the Barry Wilde Bridge at Parramatta. John Sheean was the project manager for the bridge, which was designed under the direction of Roger Smith. The bridge was required to have an aesthetic design to blend into the banks of...
the northern end of the Parramatta River. The eventual design was quite exquisite, if one could use such a term, for a medium size bridge. A special feature was the introduction for the first time in Australia of a French invention, using reinforced earth for the retaining walls. It was a new approach which was regarded with some scepticism by bridge building authorities (most innovations seem to be so regarded) but the use of the system, permitted by John Reid, Australian agent for the French company, was a great success. It was a precedent for Australian bridge building and was soon used with success by engineers of the Blacktown City Council and the New South Wales Department of Main Roads.

The Barry Wilde Bridge has specially designed ‘Y’ shaped piers and massive precast concrete sections for the deck of the bridge. The sections were cast on the bank and lifted into position.

The late 1960s saw numerous large mining developments and GHD’s involvement in the two road/rail bridges at Weipa on Cape York Peninsula for Comalco. These bridges, totalling 1300 metres in length, are designed for loads well over normal highway and railway standards. Because of the shortage of local materials, a novel feature of the design was the use of bauxite pisolites as coarse concrete aggregate in all reinforced concrete work.

GHD’s major commission to survey, design and supervise the 225 kilometre Greenvale Railway included thirty-seven bridges with a total length of 2860 metres, the longest being the 415-metre Burdekin River Bridge. This latter bridge was the longest prestressed concrete bridge to be built in Australia to that time.

GHD’s experience in bridge engineering has been significant for more than five decades. The range of bridge types in both urban and remote rural
environments has ensured that the company has developed staff with the appropriate expertise to handle bridge designs to accommodate a wide variety of situations.

Some of the designs carried out by GHD include wide river crossings with deep foundations; the use of self-weathering, corrosion-resistant, high strength steel; design for off-highway vehicles (usually used by mining companies) with axle loadings three to four times that of the conventional vehicle; curved, prestressed continuous concrete construction; and use of reinforced earth abutments.

GHD earned an award for the spectacular two-lane flyover from Bagot Road over the Stuart Highway, Darwin, Northern Territory.

Railways in Australia were built in the foundation years on a purely State basis, with no thought of possible dangers to the environment and with little regard to the future needs of our country. One aspect alone, the building of different rail gauges in each State, has cost Australia billions of dollars in lost time and additional handling costs, to say little of the inconvenience to millions of travellers. Railway engineers are now a distinct and important
The electrification of the Illawarra Railway (N.S.W.) earned GHD-Transmark an Excellence Award from The Institution of Engineers.

section of the engineering profession.

GHD has prepared preliminary reports and/or carried out detailed design and supervision for more than 3500 kilometres of railway in New South Wales and Queensland. The lines have been built for mining purposes — haulage of coal mostly — for haulage of sugar cane and for passenger and goods traffic.

In 1984 GHD began carrying out the investigation and project management for the electrification of fifty-three kilometres of double track on the Illawarra Line, New South Wales. The completion of this means a major change in the commuting arrangements for that district.

Another massive job (due for completion in December 1987) is the East Hills-Glenfield Line, also in New South Wales. GHD was appointed to manage the total project which, like the electrification of the Illawarra Line, must substantially change the travel habits of people in the expanding Campbelltown district.
Railway work seems to be ever present in the GHD design rooms at Brisbane, but it never becomes a dull routine. An exciting project was the completed study, in 1984, of a route for a new rail track through the main Dividing Range near Toowoomba. The original track has done sterling work but its tight curves and general route make it unsuitable for the longer trains and heavier loads envisaged as an inevitable result of mining the district’s large deposits of coal.

A major railway project in Queensland which entered the construction stage also in 1984 was Main Line Electrification. With several consultants, GHD in the late seventies was engaged to undertake a feasibility study for electrification of the main lines from Brisbane to Toowoomba, Brisbane to Rockhampton and west to Blackwater. Following on this feasibility work GHD, with two joint-venture partners, was engaged to design the electrification of the railway from Gladstone to Blackwater and to mines in the immediate area. In early 1984 GHD was commissioned to provide project management services to Queensland Railways for the construction phase of this project. GHD has thus been involved in the feasibility, design and construction of this major undertaking. Subsequently this commission was extended to cover project management services and major engineering work for the whole of the Goonyella railway system and the main line from Brisbane to Gladstone.

Australians are taking to the air in increasing numbers. Airport projects need a multi-disciplinary team of engineers to work together and coordinate the designs required by clients, who request assistance for such ports as the International Terminals of Tullamarine, Brisbane and Sydney or for tiny airstrips built to service the outback in the far north of Queensland.

By 1986 GHD had designed, built, investigated or augmented fifteen airports, from the runways to the kitchens in the terminals. Its engineers will design any conceivable part of an airport complex and will provide evaluation of aircraft movement forecasts and economic evaluation studies required for planning development programmes in growth centres.

Since the Federal government introduced the policy of transfer of ownership and control of regional airports to local authorities, GHD has assisted in the preparation of local ownership plans and implementation of improvements to cater for more advanced aircraft, increased passenger requirements and upgrading of terminal facilities.

Much of the design at Australian airports is original; two designs, however, are particularly worthy of mention.

In 1980 GHD was appointed by Mines Administration Pty Ltd to design and supervise construction of an airstrip for the Honeymoon Mine in South Australia. To achieve optimum moisture content and satisfactory compaction, water had to be added continuously to the pavement material during construction. Because all stored surface water in the region was required for stock watering, saline water from bores was used. The completed airstrip pavement is 45 metres wide and 1350 metres long and requires only occasional watering. The first aeroplane touched down on the strip in August 1982.
Another outstanding project was the design of an economical lightweight tubular structure for the Doppler Very High Frequency Omnidirectional Range (DVOR) beacon, developed by Amalgamated Wireless (A'Asia) Limited, so that it can be packed and transported for erection in remote areas.

A feature of the design is that under extreme temperature and wind conditions the antennas cannot move to any appreciable degree in relation to each other or to the flat wire mesh surface of some thirty metres in diameter.

A significant contribution by GHD to Australia's defence planning is in regard to the F/A-18 Hornets.

The first of the RAAF's new F/A-18 Hornets, described as the world's most advanced multi-role fighter, arrived in Australia early in 1985. As part of the project to equip the RAAF with the new planes, an airbase capable of supporting Australia's fighter force in the twenty-first century is required. Initial studies of existing and proposed civil and military airfields revealed that the most suitable airfield for the new Hornet was the RAAF Base Williamtown, near Newcastle, New South Wales. Upgrading of the Base was estimated to cost $106 million, mainly for new hangars, maintenance buildings, administrative facilities and engineering services to replace the World War II vintage facilities.

GHD was commissioned jointly by the Department of Defence and the Department of Housing and Construction to prepare an Environmental Impact Study (EIS) for the fighter project at Williamtown. The study considered the impact of upgrading and operating the base at an increased level of activity. The issues addressed by the GHD study team were population, local and regional economy, housing, community facilities and services, urban and rural development, transportation, natural features and conditions, archaeology, water and waste management, air quality and noise.

The study commenced in November 1982 with a seminar organised by GHD and hosted by the RAAF Base Williamtown. Participants at the seminar included the GHD study team, RAAF and Department of Defence officers, officials from nearby local government councils and representatives of State and local government departments and supply authorities. Major aspects of the EIS were discussed and input was received from all participants.

Following the seminar, members of the GHD study team undertook detailed examination of the existing environment on the Base and surrounding areas. After baseline data on all aspects had been obtained, the probable effects of the base upgrading were determined.

The study concluded that the project would have significant direct and indirect benefits for the surrounding community and the RAAF Base itself. The major impact would be in the areas of employment and population levels. Positive benefits would flow to local housing construction and community facilities. The study considered the impact of increase in noise levels in the vicinity of the Base and the Salt Ash Air Weapons Range.

The draft report was presented in February 1983, only three months after
the study commenced. Subsequently, GHD was commissioned by the Department of Housing and Construction to assist in presenting the EIS to local government councils, community groups and the New South Wales Department of Environment and Planning. Public comment was invited and was considered in the preparation of the final Environmental Impact Statement, which was presented to the Parliamentary Works Committee in April 1983. Following consideration of this and other submissions, construction on the Base commenced.

The redevelopment of Cairns airport was one of the largest single jobs ever to be undertaken by GHD in North Queensland. The transformation of a relatively small airport with poky little terminal buildings to a massive international complex capable of handling planes of any size is a feat in itself. What has made it more extraordinary has been the short space of time in which the transformation has taken place.

Cairns airport is quite unique; almost at the outskirts of the city it is surrounded by a range of heavily wooded hills, trapping the heat which combines with a deep humidity making it almost tangible.

The airport has had a long history of spasmodic development since it was founded in the mid-thirties on the mangrove swamps adjacent to the Barron River. During World War II it was developed significantly to handle military craft by further reclamation and filling of the swamps to enable the runways to be extended. It played an important part during World War II servicing New Guinea and the Islands. Between 1960-76 further upgrading of the airport was carried out to allow its use by jet aircraft up to 727 standard, but by 1982 the terminal buildings, tiny one-storey structures, were hopelessly out of date and were inadequate to handle the increasing air traffic. The new buildings have been designed to handle the estimated increase in passenger use to the year 2000.

The transfer to local ownership speeded up the decision-making to upgrade the airport but, in a region where local issues are important, there was much heat generated over the decision to place the new international terminal at Cairns rather than at Townsville. Cairns won the day. The two cities have such a rivalry between them that in January 1984 the mayors of both cities called for a new attitude, suggesting that a united effort be made in publicising and developing the north. It was like a peace treaty.

In January 1982 the Port Authority of Cairns, now controlling the airport under more recent Commonwealth government legislation, commissioned GHD to enlarge the runways, to build a new access road, to design and supervise new terminal buildings and to manage the whole project. GHD was required to provide for workshops, car parking and other facilities, and to complete the job with appropriate landscaping. The first international plane was scheduled to arrive on 31 March 1984.

A new access road to the airport itself presented special problems. Built through a thick mangrove swamp, a team of surveyors under Bruce Bettany at times worked waist-deep in the muddy waters. It was arduous survey work, although not all that unusual for surveyors working in the north. The water
in the tidal swamp rises to within a metre of the road level although in North Queensland, where it rains in feet, not in inches or centimetres, that does not appear to worry anybody. The old airport runway was at times covered by floodwaters from the Barron River and even then people were not unduly concerned.

I walked around the airport one hot summer’s day with Henry Adcock, the director responsible for the total project, and his two project managers, Grahame Bruce and Des Whybird. Bruce was responsible for the overall civil works, roads and aprons, etc. and Whybird for all the buildings. Sid Brischetto and Graham Standfield were responsible for the electrical and mechanical services.

The airport was like a beehive with tradesmen, labourers and technicians working at a hundred and one jobs, but obviously with the deadline for completion in view. They did not seem to notice, as I did, the blistering 100°F heat and the heavy humidity yet it brought the sweat from me whenever I moved. I queried whether the redevelopment would be finished on time — it seemed to me to be an impossible task. ‘There will be no delay’, they assured me.

The first international plane did touch down on 31 March 1984, on target. It was a great day for Cairns and a great day for GHD.

In the 1970s aircraft were guided into most airports by a flight beam which, when attuned to the instrument panel before the pilot, would indicate whether the plane was left, right, above or below the glide path signal. It was an excellent system and worked well but it just wasn’t good enough to cope with the massive increase in air travel.

Prior to the jet era it was normal for planes to approach an aerodrome by a straight low-angled route. It is not like that now. Planes, in an effort to reduce noise levels, approach from and leave airports at very steep angles; the low-level approach or flare path is of a very short duration. The old system of instrument landing did not permit a completely blind landing to a touchdown, important in bad weather conditions, and the signal was subject to interference from numerous sources including taxiing aircraft.

In 1975, in seeking an improved landing system for second generation jet planes, the International Civil Aviation Organisation (ICAO) sought a complex of controls which would allow curved and steeper approaches with automated control to touchdown and roll-out point, control over low-level or flare-path approaches and the pinpointing in space of planes at a high level. This latter point was of special importance due to heavy air traffic being ‘stacked up’ in areas as far as forty kilometres from an airport while awaiting the call to descend.

It was a three-stage evaluation project and radio astronomers from the Australian CSIRO, led by Dr Paul Wild and Mr Harry Minnett, developed a landing system based on microwave signal concepts and original ground antenna design known as Interscan. The system comprises three stationary ground antennas which reflect or direct microwave signals to aircraft receivers. The three antennas give the lateral position, the height and the
flare height at the levelling-out stage.

A prototype Interscan system was originally tested at Melbourne’s Tullamarine Airport and the result was of almost unbelievable accuracy. The large jets were able to make a touchdown within fifty centimetres of the centreline. Amalgamated Wireless (A’Asia) Limited was the prime contractor for the Department of Civil Aviation on the development of the prototype evaluation Interscan system. AWA commissioned GHD to design and supervise the manufacture of the prototype antennas.

On a purely human issue, the structure was required to be of minimum height — pilots have a distinct aversion to high towers in the vicinity of flight paths to airports.

The project designer for GHD was John Fisher, a structural engineer. Two of his problems were wind and temperature extremes and their effect on the antennas; any substantial movement in the structure from either of those two factors could seriously impede the accuracy of the information received and despatched from Interscan.

Because of the worldwide installation potential of the antenna system, wind and thermal-induced loads due to temperature extremes, including de-icing requirements, had to be investigated along with low temperature embrittlement of components. A special pigmented white paint of self-chalking titanium dioxide was used as a finishing coat. It has a highly reflective finish and results in low heat absorption, with consequent reduction in distortions due to temperature differentials. Similar paints are used on oil storage tanks to minimise thermal expansion and contraction.

The antennas and associated reflector panels were designed on a modular concept to permit increase or decrease in spatial coverage and ease of fabrication and transport. Manufacture of the reflector panels was to very close tolerances. Special installation alignment equipment was designed and installation techniques developed with the assistance of the National Standards Laboratory.

A happy aftermath to the installation of the system at Tullamarine was the presentation by the Association of Consulting Engineers Australia of an Engineering Award to GHD in recognition of the outstanding merit of the project.
Leisure

He thrust his joy against the weight of the sea;
climbed through, slid under those long banks of foam —
hawthorne hedges in spring, thorns in the face stinging).
How his brown strength drove through the hollow and
coil of green — through weirs of water!
Muscle of arm thrust down long muscle of water;
and swimming so, went out of sight
where mortal, masterful, frail, the gulls went wheeling
in air as he in water, with delight.

'The Surfer'
Judith Wright (1915-)

Leisure in Australia is one of our fastest-growing facets of life. Holidays
are being lengthened — some industries receive six weeks annual holidays
and there are thousands of educational staff who receive up to three months
a year. Working hours per week are being shortened and the trend is to early
retirement. This latter trend has thrown even greater emphasis on special
leisure activities for our ageing population.

In 1985, out of 365 days a year, our recreation days averaged a minimum
of 133, but the trend towards nine-day fortnights is increasing this figure.
Leisure has also been materially altered since World War II, with the influx
of people of different nationalities and the increasing migration of Australians
of retiring age to follow the sun and re-establish themselves in our coastal,
rural and resort towns.

All of this points to a growing need for better and more diverse leisure
and recreational facilities.

For more than fifty years GHD has been playing an important part in
Australia to enable people to have the services and facilities they need for
their lifestyle — the purest of drinking water, sewerage services, urban
planning, the ability to travel by road, rail or air wherever they wish and so
on. Now, leisure facilities within our beautiful environment are an ever-
increasing need in this country.

The range of sporting facilities in which GHD has been involved shows
that there are apparently no sports in which they cannot assist.

Skiing has come into its own in Australia since World War II. The
growing popularity of this sport has been activated by migrants who skied
in Europe as a winter pastime. It is not a sport which simply requires the purchase of a special pair of boots, appropriate clothing and a pair of skis. Accommodation must be provided for the holiday-makers, roads built to the snowfields and, above all, the delicate environment protected.

GHD is adviser to the Forests Commission of Victoria. One project already prepared is the draft of a village centre redevelopment plan for the Victorian ski resort of Mt Buller. The plan included transportation aspects and a programme ready for implementation.

Cycling has returned to Australia in two ways: firstly, as leisure for personal enjoyment plus the spectator sport of cycling and, secondly, as an alternative method of transport.

Cycling as a method of transport has worldwide acceptance. It is cheap, it does not harm the environment and it has the advantage of increasing or maintaining physical fitness. The great disadvantage of cycling as a means of transport is that the cyclist has to share the road with motorised traffic, a hazard even for the motorist, let alone the unprotected cyclist.

In one particular town in England a cyclist may criss-cross the town without ever sharing the road with a motor vehicle. The plan was conducted as an experiment, with the result that almost the whole town took to the cycleways.

GHD engineers and planners have made comprehensive bicycle plans for the Cities of Melbourne, Newcastle, Maitland, Geelong and Adelaide, covering every aspect of the introduction of cycleways. The studies included not only the comprehensive engineering but the education of the public into their use and methods of enforcing and encouraging people to use them properly.

Cycling as a sport attracts an increasing number of spectators, but if Australian competitors are to take their place in world competitions they require world-standard velodromes.

GHD-Dwyer designed a velodrome at Waterworth Park, Tempe, New South Wales, that was innovative in all respects. The client, Canterbury Municipal Council, requested an investigation, conceptual planning, design and supervision of construction of the velodrome, which included the velodrome track, grandstand, groundsmen’s facilities and utility services. It was to be a complete job.

The proposed site was a problem. It had been an old garbage tip which had been covered with fill some years before and with a further layer of fill about five years prior to the decision to build the complex. The garbage and fill rested on twelve metres of estuarine clay. Estuarine clay has a disconcerting habit of ‘sinking’ under heavy pressure, this feature being responsible for its being described as ‘highly compressible’.

The engineers decided that the track would need to be supported by piles rather than just sit on a formwork of earth and, in the client’s interest, chose wooden piles to do the job, driving them twelve metres through the clay to bedrock. Piles driven through compressible soil which has not finally settled induce great strain called ‘negative friction’ on the pile itself. To overcome this real problem it was resolved to slip-coat the timber piles with bitumen.
It was an original idea to overcome a common problem encountered in Australian building, as competition for space in built-up areas has resulted in structures being built on progressively worse site conditions such as reclaimed swamplands and old rubbish tips.

The completed velodrome is a model for others to follow. It complies with the rigid requirements set down by the UCI (Union Cycliste Internationale) and the finished riding surface was approved by the New South Wales Cyclists' Union. It is a velodrome of world class and there has even been a small bonus — the inside ground of the velodrome is used regularly by 'touch football' enthusiasts.

The construction of this track has been a major step in the advancement of competitive cycling in New South Wales. Max Brand was the project manager and Lance Horlyck the project engineer.

The Brisbane City Council commissioned GHD to provide design and construction phase services for the Chandler Park Velodrome grandstand and amenities building for the 1982 Commonwealth Games in Brisbane.

The Wrest Point Hotel, Hobart, is an example of a more sophisticated style of leisure. A multi-discipline team from GHD was involved in the design and completion of this, Australia's first great casino, the Wrest Point Hotel and Casino.

GHD was responsible for the design and supervision of construction of all the engineering services for the hotel, including the engineering of the siteworks. In addition to the structure and siteworks, GHD engineers also designed the water, electricity, sewerage, water heating, cooking and refrigeration services, the heated swimming pool and all internal and external communications systems, together with the control systems for all of these services.

In new towns, or in older towns where disused land such as old garbage tips is available, GHD provides services and comprehensive planning of complete leisure and recreation facilities. Very often, where large tracts of land are available, the heart of the plan is the provision of a golf course.

In such cases the environmental aspect is of paramount importance. At Collier Park, Perth, Western Australia, GHD, in association with W.T. Coate, Thomson, Woolveridge and Associates and J. Gordon, produced a recreational needs survey, conceptual planning, feasibility assessment, detailed design and construction services for conversion of a plantation and tip area into a sporting complex involving an eighteen hole golf course, multi-use playing fields, passive recreation areas and, finally, indoor sports facilities. The course and a modern indoor centre were opened in 1984.

A survey for a growth area was carried out for the Shire of Waroona, Western Australia, to determine the recreational needs for a town with rapid population increase arising from construction of the Wagerup Alumina Refinery and its new employees.

There are many other examples of overall planning for recreation facilities but I personally like the concept of the project covering detail design for a one hundred and twenty acre development at Rapid Creek, Darwin,
incorporating water gardens, shade structures and restaurant. It sounds like a piece of paradise!

GHD likes to design bowling greens. There is a lot of satisfaction in seeing a facility which one has helped to create being used to give people pleasure.

GHD played an important role in the preparations for the Fourth World Bowls Championships held at Frankston, Victoria, in January and February 1980. Twenty teams representing nations in America, Europe, the Pacific Basin, Asia, Africa and the Middle East competed during the eighteen-day championships. The average age of the registered competitors was around forty years.

Bowls is one of Australia’s most popular participator sports and about half of the world’s bowlers live here. Interest in the championships, which were opened by the then Governor-General, Sir Zelman Cowen, was very high.

The site for the Frankston Championships was restricted to 3.4 hectares, encompassing the City of Frankston Bowling Club and adjacent undeveloped land. It was a challenge to design the facilities required on such a block of land, less than half the size of the block used for the previous World Championships in Johannesburg.

GHD was commissioned by the Site Preparation Committee in February 1978 to evaluate and report on the capacity of the proposed site in relation to spectator-viewing accommodation, parking and transport, engineering services and public safety. The plans envisaged temporary grandstands with catering and other facilities supplying services for approximately six thousand spectators. GHD’s services included advice in town planning requirements, site planning and engineering matters, liaison with public authorities, title re-establishment and site detail surveys, engineering design and contract administration. The firm’s work was coordinated in the Melbourne office by Ian Hatfield.

Most people prefer to read in a good strong light, and it is not unusual to find 100 watt globes in many rooms of Australian homes and 150 watt globes in the larger areas, such as the lounge.

When looking at some of the statistics of the celebrated lights at the Melbourne Cricket Ground, however, most people could not even remotely envisage the power of a 2000 watt lamp, let alone the 844 floodlamps of the same strength on the six towers.

The $4 million floodlighting system is one of the largest of its type in the world. GHD project managed and engineered the scheme, carrying out design studies and preliminary proposals, assisting with planning permits, environmental impact assessment, detailed design, contract administration and contract management.

There were lots of problems. In the environmental aspect local residents were not amused at the plan to raise six towers, each equal in height to a twenty-five storey building. They were even less amused at the prospect of their houses being bathed even in the fringe area of the light produced by almost two million watts.

It all worked out. The light-spill over most residential areas nearby was
limited to levels comparable to the illumination of house-fronts from street lighting. Other problems, such as the effect of glare on car drivers using local roads, and on train drivers, were also solved, mainly by use of computer and photogrammetry programs produced by GHD.

Not the least of the problems encountered by the practice was the much publicised campaign of industrial action by the Builders Labourers’ Federation over a union demarcation dispute. It was an ugly side of the Australian industrial workplace and was not confined to mere words or the stopping of work. There was a surfeit of verbal and physical intimidation of personnel and of property damage. On one occasion a GHD engineer was the victim of actual physical assault by pickets.

It’s all finished now and is working. For those cricket fans who savour statistics, the towers are tubular in section, fabricated from 20 millimetre steel plate, reducing to 16 millimetre at the top; they are 4.2 metres in diameter at the bottom, reducing to 2.0 metres at the top, and contain 120 tonnes of steel each. The foundations for each tower consist of four 1.0 metre diameter piles down to rock, surmounted by an 8 metre square 1.4 metre thick pile cap. The 844 metal halide floodlamps and ancillary equipment consume 1.8 million watts. A pleasant consequence of the project was the acceptance by GHD director Ivan Miller of an Award of Merit for the floodlights, presented in December 1985 by the Association of Consulting Engineers Australia.

GHD’s project manager for the planning and design phases was Miles Pierce and Rob Taber of the Melbourne office supervised construction. Peter Manger was the director responsible.

Swimming is one of Australia’s most popular sports. GHD engineers have been involved in design and construction of an enormous number of swimming pools and complexes in every State of Australia and in Malaysia. In the early 1960s GHD was to the forefront in the planning and development of many
of the large multi-pool centres installed by councils and smaller facilities for schools. John McCann was responsible for the planning of a large number of these projects in New South Wales and South Australia. He assisted in the development of standards which were applied to similar projects in other States.

Since that time the accent has been on indoor heated pools, not only to provide pleasure for swimmers but to allow training all-year-round for competition swimming. Specialising in this branch of leisure GHD engineers, by the massive use of solar collectors, supported by supplementary heating
when required, have made indoor swimming a year-round sport. They have brought the pleasure of swimming to disabled people by including ramped access to the building entrances, special change and toilet facilities, and have designed stepped ramps at poolsides to permit direct access to the water.

At the indoor swimming centre constructed for Ryde Municipal Council, there is even a band of raised textured tiling around the perimeter of the pool to assist blind people to locate the water edge.

At the University of New South Wales Swimming Centre GHD engineers designed a full perimeter service tunnel which incorporates underwater windows for coaching. What will they think of next?

It could become boring to keep on enumerating the sports to which GHD engineers have made a contribution — Rugby League, Athletics, Rugby Union and Soccer.

Although there have been many projects completed, the task set GHD engineers at Leichhardt Oval, New South Wales, the home of the Balmain Tigers, will be of interest to football fans. Formerly a cricket oval, the field was hard, carried a significant slope and appeared to be the wrong way around anyway. The engineers levelled the field, installed an automatic underground watering system, turned the run of play in another direction and provided prestressed concrete seating on the embankments to accommodate 16 000 spectators. After the first game the Tigers and their fans roared their approval.

Childrens’ playgrounds are, perhaps, one of the most important leisure facilities. It is here where a child can find his or her play physically and mentally challenging and where they may play out adventures and release their high spirits and boundless energies. GHD engineers find the planning of children’s playgrounds very rewarding. They have designed many.

The Australian trend in tourist resort complexes appears to be developing along lines similar to those found in the Hawaiian Islands and other parts of the world favoured by a congenial climate and attractive scenery.

In 1985 GHD was appointed as consulting engineers for the new international resort development at Four Mile Beach in far north Queensland. At the same time GHD opened an office in the nearby historic town of Port Douglas to serve this growing area.

The resort project, now known as the Mirage Port Douglas Resort, is not small, or even large — it is, in anybody’s language, massive. When complete it will comprise a 400 room international resort hotel encompassed by a 2 ha swimming lagoon (the largest in the southern hemisphere), 400 units for private sale, a 400 berth marina and a golf course. Multi-purpose sports facilities, a retail shopping complex and an historic village are also planned. It will be a complete resort town, and will involve expenditure in excess of $150 million.

The extent of the involvement of GHD, which covers all aspects of engineering, illustrates the versatility of the practice in North Queensland and its ability to handle complex and novel projects.
The Mirage Port Douglas Resort has a 2 hectare saltwater swimming lagoon.
THE ENVIRONMENT

He crouches and buries his face on his knees,

And hides in the dark of his hair;

For he cannot look up to the storm-smitten trees,

Or think of the loneliness there —

Of the loss and loneliness there.

'The Last of His Tribe'
Henry Kendall (1841-1882)

Australians have only in recent years developed an interest, which is now almost an obsession, in the environment and its preservation.

Governments have become interested also. The Franklin River argument and its aftermath may continue to arouse passions for many years to come.

It was not always so. Fred Machin, who retired as a GHD partner in 1966 after serving the company for twenty-seven years, said that in his experience 'the environment and its care took second place to the completion of the job'. Another partner, Ken Inglis, who retired in 1971, affirmed that he had scant regard for the effect of a job on the environment.

The picture has changed and GHD has been in the forefront of environmental studies since the first guidelines for formal studies were set out in the early 1970s.

The interest by GHD in this field was accelerated in early 1979 when GHD merged with the practice of D.J. Dwyer & Associates, consulting engineers, town planners and landscape architects. Since 1965 Don Dwyer had established this firm as a specialist in urban development and environmental fields.

Environmental planning is no longer confined to isolated areas of rainforest, sand dunes or strips of coastline. The studies have become closely linked with urban planning and development, recreational and resort planning, in addition to pure environmental studies of the impact on the delicate balance of nature by new projects.

GHD in recent years has been involved in projects covering studies of over one hundred areas where the preservation of the environment was essential. One of the projects included an ecological study of the River Murray and its floodplain as related to the development of the Albury-Wodonga growth plan. The project included physical, chemical and biological studies of rivers and of Lakes Hume and Mulwala in their relation to the birdlife and botany of the floodplain. Another interesting assignment was the preparation of draft State Environmental Protection Policies for twelve lakes in the western district of Victoria.
Although GHD has been involved in some massive environmental studies, it has also given its full expertise to some small and unusual ones which, nevertheless, were considered by those commissioning them to be important.

One important job involved coastal management in Queensland. In April 1975 GHD submitted to Sir Charles Barton, Coordinator General, Queensland, a comprehensive report on the management of Queensland’s coast from the New South Wales border to the northern boundary of Noosa shire. The report shows clearly the impact on the environment of even the simplest inroad into the natural habitat but, at the same time, provides solutions which would preserve for all Australians the natural beauty of this magnificent coast.

The investigation covered three main fields, each in itself a major project: wetlands and aquatic investigation, engineering investigation of canals and land use investigation. The total project was directed by Norm Traves and managed by Bob Macintosh with a team of senior consultants from GHD. In addition, specialists in many fields were recruited to assist.

The completed report included these among its important findings: coastal erosion is expected to continue and land use allocations should avoid intensive development along the waterfront and, in addition, areas should be allocated as ‘open space’; mangrove, salt marsh and seagrass areas are of significant importance in terms of fish production and the principal areas should be preserved except where required for essential waterfront purposes; sandbanks and estuaries are important for fish life and should be protected from degradation wherever possible.

The report covered every aspect of the impact of settlement and of the intrusion of mining on the coastal area. Of particular significance was the study of the reaction of the environment to man-made canals for residential purposes. Rob Harrap, an expert on coastal waters, made exhaustive tests in this field.

The implementation of the report must help to preserve this section of our coast for all to enjoy and wonder at.

In days gone by a new highway not only destroyed much of the area through which it was built but, in addition, produced a strip of visible pollution.

GHD’s experience in the aesthetics of highway and road location and design was a factor in its being called upon to investigate the Victorian section of the Hume Highway. The highway was analysed within a framework of five distinctive landscape units, each defined by significant natural features.

Recommendations not only included increased facilities for tourists, but gave tourists the opportunity to slow down a little, here and there, to enjoy the scenery. Other recommendations included the protection and regeneration of tree cover, especially on farmlands where modern farming practices prevent natural regeneration.

Since the decade of the sixties the concept of solar power has become very popular, not only as a method of conserving energy but as an environmental non-pollutant. GHD is interested in the use of solar power for
both of these reasons.

The use of solar power has been adopted by GHD to heat swimming pools, in Victoria and New South Wales particularly, and in the heating of buildings generally. The State Swimming Centre in Melbourne, the Ryde Municipal Swimming Centre in New South Wales and the fifty metre pool for the University of New South Wales were all designed by GHD with the use of solar heating as a major reduction in annual power costs.

The residents of the Kamilaroi Retirement Centre at Lane Cove, New South Wales, comprise one group of people who do appreciate the use of solar power, both as an environmental safeguard and as an economical supplier of energy. In the green surroundings of the cottages the Centre is like an oasis of peace. The residents point with pride to the fact that their hot water system is powered by the sun.

One of the greatest environmental problems to arise in Australia since the 1960s has been the increased salinity of the Murray River. It is a problem which will not go away and which, if not checked, could destroy much of our environment and with it also the standards of living of hundreds of thousands of Australians including many engaged in primary production.

GHD, in association with the British firm of Hunting Technical Services Limited, was commissioned to prepare a report which was submitted to the River Murray Commission on 24 March 1970. Terms of reference for this important task were set out in 1967 by the Commission.

The report covered twenty major areas of research including the environment, use of Murray Valley waters, farm management in relation to salinity and special reports for various geographical areas.

The conclusions were that the measures found for the improvement of both existing and expected conditions of salinity in the Valley were justifiably and technically feasible.
It is estimated that, if the current trends continue, some 520,000 hectares of land in the irrigation areas will be affected by salt by the year 2020. Salting is also increasing in dryland areas. In the Mallee district alone, the area of salt-affected pastures is increasing by two percent per year.

In the mid 1980s a joint committee of the Victorian State Parliament released for public comment the results of two further studies on the causes and effects of salinity in Victoria and possible solutions to the two problems. The studies were undertaken by a team comprising GHD, agricultural consultants ACIL Australia Pty Ltd and Australian Groundwater Consultants Pty Ltd. GHD was the prime consultant in the investigation of salinity control techniques.

The ground water in Northern Victoria is generally fairly saline. When the watertable rises to within about two metres of ground level, water is drawn to the surface by capillary action and evaporates, leaving the salt behind in the surface soil. High watertables also lead to inflow of ground water in the streams, thus increasing their salinity.

The studies found that the potential for salting problems exists over much of northern Victoria. The area affected by high watertables is still increasing, particularly in the Shepparton region. In irrigation areas, where high watertables are due to seepage from channels and from overwatering, the problem has been recognised for many years. More recently, however, salting has become evident also in many dryland areas, where watertable rise is due to past clearing of the deep-rooted native forest and its replacement with shallow-rooted pasture and crops.

More than twenty techniques for dealing with salinity problems were identified in the studies. They range from controlling watertables, by pumping or other means, to simply adopting farm management practices best suited to saline conditions.

Householders in Australia, almost without exception, are unhappy with any smoke, toxic gas or malodorous odour which deprives them of their clean ‘fresh air’.

The control of objectionable odours from factories, abattoirs, wastewater facilities and such is a major problem for modern-day engineers but, like the control of effluent into rivers and streams, it is one for which the public demands a solution.

GHD’s involvement with biological odour removal in Queensland began with a pilot study initiated at the Redcliffe Wastewater Treatment Plant in 1972. The success of this study led GHD to pioneer the design of biological odour removal towers in Queensland. The system has low running costs, requires no chemicals, has no chemical effluent requiring disposal and is sufficiently robust to handle varying loads automatically without sacrificing efficiency.

Forward planning of a major port, which includes caring for the needs of the local crocodiles, is a fairly unusual task but is the type of commission which does not raise a hair at GHD.

The GHD practice was asked by the Cairns Harbour Board to prepare
a development plan for the port, for the next twenty-five years. While most river ports move down river when compelled to do so by increased shipping size, the Cairns port, which is already on the mouth of Trinity Inlet, had only one way to go — up the inlet.

The problem for the local people who treasure their environment is that 'up the inlet' lies Admiralty Island, the breeding ground of local crocodiles. The island is a low-lying body of land covered with mangrove and forest and is of considerable ecological value as a marine food source and fish habitat. Care was exercised when making recommendations to minimise the ecological impact on the island. The crocodiles should be able to continue to live and breed there.

When the new shiploading facility for Port Waratah was broached, with its necessary stockpiling of thousands of tonnes of coal, the Newcastle City Council discussed the problem with the Department of Environment and Planning. The proposed stockpiles of coal (four) would each be one kilometre long and even in a moderate breeze the fall-out of coal dust could be of extreme discomfort to local residents.

The Department of Environment and Planning advised the council that they should require the developer to fully enclose the four stockpiles. The cost of such a protection was astronomical and, because of its size, quite impractical, but was solved by Planner West (now GHD-Planner West) who were responsible for design and project management for the facility.

Vic Cimadori, one of Planner West’s engineers, and Ted West, one of the partners, were interested in the project. They worked with the developer’s chemists and they proposed a new dust control technique which would eliminate the need for the expensive and impractical enclosure of the stockpiles. The new technique, used during conveying and loading operations and on the stockpiles, was to spray a chemical on to the coal as it arrived. This formed a crust on the surface of the stockpiles and controlled dust during reclaiming and shiploading operations.

Many months of developing and testing were necessary as part of the complex design but the total facilities opened on time with the dust problem solved. As an added bonus the chemical treatment cost only a modest five cents per tonne of coal. The innovation was so well received that it won for Planner West an Award of Merit from the Association of Consulting Engineers Australia.

For some years baby turtles were successfully raised from eggs and hatchings in the islands north of Thursday Island.

Full turtle farming, of turtles to a marketable size — say thirty-five to fifty kilograms — was a desirable project but had only been achieved at one other spot in the world, at Grand Cayman Island in the Bahamas.

Is turtle farming, with no precedents whatsoever, the business of consulting engineers?

GHD made it so. In 1976 Bob Goakes and Ralph Hawkes proposed a 'sea crawl', fenced with natural timber and bamboo for economy’s sake. The crawl was erected on Badu Island, fifty kilometres north-west of Thursday
Island. It was erected on a suitable beach using ‘A’ frames for structural strength and ballasted with rock to resist the sea. Bamboo sheeting inside the fence contained the turtles, while heavy external timbers excluded sharks or crocodiles with a taste for turtle meat.

Problems included swift currents, half a metre of mud, large sharks and an occasional salt-water crocodile yet the project was completed by forty men in six months at a fraction of the cost of a system using conventional materials.

*The stockpile spray system at the Port Waratah Coal Loader (Newcastle) is used in conjunction with chemical treatment of the coal to minimise coal dust pollution.*
GROWING STRONGER—
THE ASSOCIATED COMPANIES

They would be makers of fabrics, of cloth for the continents—
Makers of mighty engines and delicate instruments;
It is they who would set fair cities on the western plains
far out,
They who would garden the deserts—IT IS THEY
WHO WOULD CONQUER THE DROUGHT!

They see the dykes to the skyline, where a dust-waste
blazes today,
And they hear the lap of the waters on the miles of sand
and clay:
They see the rainfall increasing, and the boundless sweeps
of grass,
And all the year on the rivers the strings of barges pass.

'Australian Engineers'
Henry Lawson (1867-1922)

GHD began with A. Gordon Gutteridge, who was a great engineer but
was only one man. He could have set his mind to a multiplicity of engineering
projects, and indeed was involved in many and varied ones, but his main forte
at a time when work was scarce was a concentration on water and its offshoots
— drinking water, storage, reclamation, sewerage.

Davey was a similar type of man, as was Haskins, but individually their
own expertise was necessarily limited in a world of expanding engineering
disciplines.

Their working together on joint ventures and their final amalgamation
produced a consulting practice which could cater for a larger number of
disciplines and complete design and services with their own staff.

The specialist consultant becomes more expert as his experience grows
in his own specialist field and GHD has increased the depth of its expertise
by merging with other firms possessing specialist skills.

At times it is wiser to associate with another specialist firm to complete
a specific project. The undertaking becomes a joint venture which uses the
skills of both organisations. In other cases it is of advantage to merge permanently with another firm when the combined expertise of both will be to the permanent advantage of both.

One such firm was D.J. Dwyer & Associates Pty Ltd.

Don Dwyer had begun his consulting career with the firm of J.T.S. Ryan & Co in 1961 after a career in local government. In a manner reminiscent of a prominent television ad for a brand of shaver, Don liked the business so much that he bought it in 1965, forming the firm of D.J. Dwyer & Associates with himself as sole principal. He was thirty-five years of age and had already been in private practice for five years. The practice expanded in a spectacular fashion, but built in a protection against downturns in sections of the industry by diversification into a wide variety of disciplines, including civil and structural engineering, town planning and landscape architecture.

The expansion of the practice meant a rapid increase in the number of staff and Dwyer recruited some young engineers whom he had previously known in the area of local government. Dwyer did not paint a rosy picture: there would be no overtime, but long hours; no guarantee of security but, if hard work, skill and enthusiasm meant anything at all, the rewards in job satisfaction would be great, with good salaries being paid as the business grew.

The new staff revelled in what they saw as a new-found freedom, unfettered by the dead hand of bureaucracy, plus a chance to show their own skills. They worked hard, thirteen to fourteen hours a day was the norm, with conferences afterwards to assess the progress made. There were occasions when the teams worked all night to complete a submission to meet a target date, going back to Dwyer's home for a 5.00 a.m. breakfast served by Margaret Dwyer. Margaret was not on the payroll, but perhaps should have been, as a caterer; quite frequently she provided evening meals in the office for twenty or more people — this was in the days before take-away food outlets.

The rapid recruitment of enthusiastic but relatively inexperienced engineers led Dwyer to request his father to join him in 1967. 'Mr Jack', as he was affectionately known, brought with him the wisdom of years and a vast experience. He was an ex-local government engineer, who had been Chief Technical Officer of the New South Wales Housing Commission, and in this position had organised government housing during the postwar housing shortage.

Mr Jack attended to the coordination of design and documentation of a significant number of major projects, releasing the young engineers from what they regarded as necessary but tedious work; they preferred field work. Don Dwyer never declined to accept a commission, but the consequent recruitment of young engineers could have been a problem. He found a solution in the adoption of the mentor system, under which a team of experienced engineers, or the 'oldies', led by Mr Jack, assisted the younger engineers in every way, from confidant to detailed advice on how to solve a particular problem. The mentors included Norm Wilson, Jack Spencer,
Frank Stone and Jim Cranney. Jack Fisher and Dick Andrews also played a vital part in supporting the younger members of the firm.

Dwyer had seen many practising engineers bogged to the eyebrows with paperwork due to the detriment of their professional output. He wanted none of this and from day one of D.J. Dwyer & Associates he sought out and engaged Dawn Hardy, a highly competent secretary and bookkeeper. Dawn maintained a tight control over the finances, as well as office procedures.

Dwyer opened an office in Canberra in 1966 and appointed John McInerney manager for the ACT region. Commissions arrived in such numbers that Dwyer asked Warwick Keirnan to join him. Keirnan, a friend from his student days, had worked with him in local government. Keirnan was attracted to the field of urban development and the success of the Canberra venture was quite spectacular. Dwyer and Keirnan achieved a reputation for zest or, perhaps, impatience; they preferred to arrive at Canberra by car ready to start work in the morning and finished when it pleased them, without the restriction of abiding by airline timetables.

They were fortunate in their recruiting of Don Barr to their team in Canberra. His skill and dedication was such that, in the later merger of D.J. Dwyer & Associates with GHD, he was appointed manager of the new office. (On my visit to Canberra I was fortunate in being able to talk to Don Barr. Not only did I find him a walking encyclopaedia on the development of the capital but he imparted information in a colourful yet lucid style that made it all so interesting.)

The success of Dwyer’s work in the Australian Capital Territory, particularly in the urban development field, prompted one of the senior staff in the government housing area to suggest that Dwyer open an office in Darwin. He did so immediately; that was in 1969. True to form Dwyer, Keirnan and Don MacMaster travelled to Darwin in a car specially bought for that purpose. The journey from Sydney included a three-day lift, with car aboard, on the old Ghan railway from Port Augusta to Alice. From ‘the Alice’ they drove another thousand miles to Darwin.

D.J. Dwyer & Associates was well received in Darwin. The reputation previously built up in Canberra in the urban development field was known and the new firm worked mainly in this field, making a substantial contribution to the Territory before and after Cyclone Tracy.

In 1971 the growth of the firm was so great that Gordon Cairns joined the practice as Finance Manager. Dwyer also needed and received the assistance of Gordon Thorn, a very special financial adviser.

In looking at the number and depth of the urban planning projects in which D.J. Dwyer & Associates were involved, it is clear that the high standard of design, coupled with a dedication to aesthetic landscaping, placed this firm in the forefront of its specialised field in Australia.

By the 1970s the staff had increased to 140, with a predominance of projects involving housing. Many senior people now joined the practice and established their future careers; they included Bert Saunders, Max Brand, Harvey Chambers and Ron Van Es. This senior group was sufficiently
experienced to take over projects in their entirety, yet this advantage led to even more commissions.

Dwyer shifted to larger premises in 1970, and hit upon the thought that an occasional day of relaxation could be good for morale. It was. He was wont to hire a bus and take forty to fifty staff to Canberra just to look at the projects in which they were involved and enjoy a lake-edge barbecue and dinner party.

Although town planning was ‘the thing’ in the fifties and sixties, Dwyer reasoned that, to protect both the continuity of the firm and the interests of his increasing staff of qualified people, he needed a balance of contracts from private enterprise and from the three fields of government — Federal, State and Local. He went out and got them. As a sole practitioner in his field, Dwyer built his organisation to a staff of one hundred and fifty, possibly the biggest one-man show of its kind in the Southern Hemisphere.

Whilst I emphasise the importance of its speciality, D.J. Dwyer & Associates was involved in a multitude of projects of quite astonishing diversity. The projects included the design and contract supervision of a major wastewater treatment plant for South Perth; a study of the history, geography, ecology, settlement and other aspects of Norfolk Island; a study in estimated growth of Alice Springs; road, traffic and urban development design in the Australian Capital Territory, Northern Territory, New South Wales, Queensland and Western Australia; a mining study, industrial redevelopment, drive-in theatres, an intensive pig-breeding farm and a host of others.

In 1974 D.J. Dwyer & Associates was incorporated as a company, with its head office in Sydney and branch offices in Albury, Brisbane, Canberra, Darwin and Perth, and an office in Jakarta, Indonesia.

The Directors appointed to the Board were all people who had grown with the practice and helped in achieving its position in the consulting profession. Dwyer became Chairman, with Gordon Cairns as Company Secretary, and Ron Van Es, Don Barr, Warwick Keirnan, Harold McKenzie, Bert Saunders, Max Brand, Graham Mackie, John Pertel and Barry Hamilton all became Directors.

One of the oddest predicaments Dwyer was ever caught in followed his association with Australian Aerial Mapping. The two companies had set up an office in Jakarta, Indonesia, and for four years carried out planning and design work in South East Asia. A fairly usual procedure in carrying out the surveys was for the ground survey staff to set up white crosses through central Java for aerial survey control. These surveys were conducted during the period of Indonesian military activity in the region and it also happened that white markers were used by the Indonesians as guide posts for their paratroops. Sadly for the survey project, the Indonesian Army decided that the markers set up by the Dwyer team were espionage and the paratroops went looking for the survey team to talk to them — with loaded weapons. The survey teams were flown out of the hinterland, at night, on charter flights. It was Dwyer’s last operation in Indonesia.
Despite the clear success of his business, Dwyer decided to approach GHD with a view to a merger to enable a wider and more comprehensive facet of engineering skills to be available to his firm and to his highly qualified staff. The merger was completed in 1979 and is now a part of the overall structure of GHD, of which Dwyer became a director.

Don Dwyer's operation in Western Australia must be told separately from his other company. If not done so it could bring down the wrath of the whole State in the west on my head. The people there insist on being treated as Western Australians and not as appendages of the eastern States.

I was intrigued as to how a 'foreign' company (from the eastern States) could make a success of an operation in Perth, where State pride is a tangible thing. The answer was, 'Take your own client with you.' That's just what Dwyer did.

For some years Don Dwyer had provided services in New South Wales and the Australian Capital Territory, in the urban development field, for the giant developer Hooker-Rex. When they asked him to provide similar services in Western Australia, Dwyer agreed immediately to maintain his connection with a valued client and in 1971 opened an office in Perth with Warwick Keirnan as manager, supported by Don MacMaster.

The pace and quality of Dwyer's work in the urban field in Perth made such an impression on local government that contracts began to flow into the office. This was particularly advantageous to the new firm, as any canvassing for commissions in Western Australia was severely frowned upon by the local consultants as a breach of professional standards.

The State Housing Commission awarded Dwyer one of the biggest developments they had ever handed out. Again, within eighteen months, the Perth Water Board had placed D.J. Dwyer & Associates on its list of consultants, a very real gesture of confidence, and shortly after awarded the new firm a large sewerage investigation scheme at Woodman Point.

By this time it would have been hard for others to have suggested that D.J. Dwyer (W.A.) was anything but a local firm. There had been, at that time, a low in consultant employment numbers following the downturn from the great mining boom of the 1960s. The result was that there was a pool of excellent engineers available for recruitment from the local scene and Dwyer recruited them.

In 1972 Keirnan handed over the management of the Perth office to Graham Mackie, who further demonstrated that success will come as a result of continued hard work coupled with a striving for perfection of performance. Mackie remained as manager of the Perth office until it merged in 1979 with GHD into the new firm of GHD-Dwyer (WA) Pty Ltd. He was appointed a principal of GHD, and, with Tom Swanson and John Phillips, a director of GHD-Dwyer (WA) Pty Ltd.

Dwyer appreciated the need for quality control over the work and to keep abreast of technology, for this was a time when the consulting engineering industry was moving into the computer era. Dwyer depended heavily on the strength of his people in the Sydney office.
It was from Sydney office that all standards were set and where major designs were expedited. It was also the office where engineers, planners, draftsmen and tracers received very specific training under the watchful eyes of the mentors, as well as such people as John Pertel, Barry Hamilton, Doug Pierce, David Avery, Ron Pollock and Brian Risdon. A dedicated team of people emerged from Dwyer’s Sydney office, many of whom can be found throughout the GHD organisation today.

Another such firm was Planner West Pty Ltd. Planner West really began on 1 July 1958 when John Planner took the plunge and set up his own shingle (in the back room of his house) as a consulting engineer specialising in materials handling.

John had had about seven years experience in this field, and believed that there was an urgent need for the design of materials handling facilities that were based on professional evaluation of all factors. He relished jobs that were a little unusual.

One such job was the design of a special machine to test the wearing capacity of various qualities of carpet manufacture. The client required a machine which could provide, quickly, sufficient data to estimate the life of a carpet. John designed a machine which could simulate battalions of soldiers or thousands of children marching through the lounge room. The client was pleased.

Key staff in the early days included Bill Saunders (materials handling), George Konyi (mechanical engineering), Sieg Sallermann (drafting) and Ken Ney (building services).

Another odd request, but a very important one, was from an airline which
complained that the tail structure of some of the new planes they had purchased were so high that they could not enter the hangars. The problem was serious and could have necessitated alteration of the doors and the roof structure of the hangars to allow the housing of the aircraft.

The solution was almost as simple as the old story, probably untrue, of the huge lorry which became wedged in a tunnel with a ceiling too low to accept the high load. The story goes that after futile efforts to pull the lorry from the tunnel, a small boy, an interested onlooker, suggested that some air in the tyres be released to lower the height of the truck and its load, thus allowing the truck to reverse under its own power. The tale of the aircraft tail is almost parallel.

Bill Saunders and a firm of structural engineers designed a jacking device to raise the aircraft nosewheel and consequently the nose of the aircraft itself, with a lowering of the tail. The aircraft, tails and all, were installed safely in their hangars.

Bill Saunders and George Konyi worked with John Planner on a number of the materials handling projects, with George making a special contribution in the design of mechanical and structural work on shiploaders and mine
headframes, which required a combination of mechanical and structural design.

George Konyi completed his engineering studies in Hungary but escaped from the oppressive communist regime then in power. Fears were held for George when he returned to Hungary to visit his parents. However, he was able to make his way back, bringing with him two Hungarian dolls in national costume for John Planner’s two daughters. The dolls had been hidden in the seat of his motor bike during his return trip.

The late 1950s saw a need for increased steel production in Australia and the practice was involved in the design of cranes and other specialised
equipment at Newcastle and Port Kembla steelworks.

In 1962 Ted West joined with John Planner, giving the end name to the firm, Planner West. Ted West specialised in mechanical engineering in all its phases, with particular emphasis on buildings. He was ably assisted for many years in the field of mechanical building services by Barry Smith. The added disciplines made a strong team which has been involved in a very wide variety of engineering design and project management in all States of Australia.

An office was opened in Wollongong when Peter Reinhardt joined the practice. Ross Sherson, a structural engineer, who had worked some years previously with GHD, joined the practice as a Wollongong office partner. This capability enabled the practice to design mechanical structures such as a series of major gas mains up to four metres diameter supported over the Port Kembla steelworks.

The practice provided mechanical and electrical engineering services to the steel industry, one interesting project being a basic oxygenised steel laboratory at AIS, Port Kembla. The spectrographic analysis laboratory was connected by pneumatic tubes to the blast furnace in order that steel samples tapped from the furnace could be quickly transferred to the laboratory for spectrographic analysis to establish whether the steel was ready to be discharged. Environmental conditions in the laboratory associated with the spectrographic analysis equipment were critical and this required very careful design of the air conditioning to ensure that the equipment remained in calibration at all times.

Since television was introduced into Australia in the 1960s Planner West has assisted with mechanical and electrical engineering design required for stations and one of the earliest projects was the Coffs Harbour television station.

It was a new regional television station and contained all the complexities of a larger station but on a smaller scale. There was a need for special attention to acoustic design of systems associated with the studio, removal of heat from console panels and control units, the wide variety of operating loads from area to area requiring multiple zones of air conditioning, and finally the incorporation of a standby diesel electrical plant to achieve reliability of operation of the station.

As is usual in a consulting practice with jobs in country areas, visits to sites by commuter aircraft with tight connections were common. On one occasion the electrical engineer had gone on the trip very reluctantly because his wife was expecting a baby at that time. Instead of a taxi taking him to Grafton on that occasion the contractor had volunteered to drive him up in his car, but halfway to Grafton a car in front threw up a stone and smashed the windscreen of the contractor’s car. The contractor naturally pulled over to the side of the road, but in his anxiety to catch the plane the electrical engineer quickly punched a hole through the window and commanded the contractor to continue on to Grafton airport without any delay, which he did.

The Australian Atomic Energy Commission used consulting engineers for some of the high technology systems required for its facility at Lucas
Heights. One of the projects handled by Planner West was a complex vacuum-operated liquid transfer system in which particular precautions against failure had to be taken because of the hazardous nature of the liquids involved.

Neil Wyles joined the practice in 1965 to develop electrical building services engineering.

It had been said that an army marches on its stomach, and it could also be said that a consulting engineering practice will starve unless accounts are prepared and fees are collected.

Bookkeeping was originally handled by Dorothy Planner and then by Joan Citer, a part-time lady, with Bernice Hazledon becoming the first full-time bookkeeper in 1967. Bernice arrived from Canada for a one-year visit but she liked Australia so much that she stayed permanently, serving with Planner West until 1982 and then taking up residence in Moss Vale. Bernice saw to it that the Planner West office was always decorated with Canadian flags on the First of July and everyone sampled Canadian cooking on that day.

The accent of Planner West appears to have been a concentration on new methods of approach to standard problems in order to reduce costs for the client, but always with its proviso that there be no reduction in efficiency.

An interesting example of this attitude was in the late 1960s when a bumper wheat crop was anticipated in New South Wales, of such dimensions that the then storage capacity would not have been sufficient to hold the wheat. Planner West, working with engineers from the Grain Elevators Board, developed a new concept in wheat storage. They designed horizontal storage facilities with concrete floors and steel-sheeted walls to keep the contents secure from rodents. The bins were completely satisfactory and were much less costly when compared with similar storage provided by the conventional silo.
One of the other main dangers to grain is weevil infestation. However, weevils cannot breed below a certain temperature and the problem was overcome by installing aeration ducts on the concrete floors to draw cool air through the grain during the night and at other times when the outside temperature was low. This system proved to be most effective.

The Grain Elevators Board had sixty of this new type of storage facility built in New South Wales.

Sydney's fruit markets had operated for almost one hundred years from a site near GHD's present Sydney office in Railway Square. However, the Sydney Farm Produce Markets were relocated to a new site in Flemington in 1973. One of the features of the extensive new facilities was the lighting installation which was designed by Neil Wyles and other electrical staff.

Peter Van Dike, Dave Lemon and Peter Siers made a valuable contribution to electrical engineering work of the practice on a variety of projects.

Brian Mahony joined Planner West in 1969 to direct the plant engineering section. He has been ably supported over the years by Phil Whittaker (belt conveyors), Ron Last (stackers, reclaimers and shiploaders), Ed Clarke, John Wagstaff, and many others.

One of the most significant projects handled by the firm was the coal handling and shiploading facility at Port Waratah in New South Wales. Planner West, in association with Docker and Smith, handled the design and project management of this facility. Design work commenced in August 1974 and the first vessel was loaded at the new berth in December 1976.

This is still regarded as one of the most efficient coal handling facilities in the world, particularly because of the large number of coal types handled. Brian Mahony was responsible for operational studies and materials handling design. Trevor Hazelwood was responsible for the programming, planning and expediting tasks. This included keeping operational, during the demolition of the old timber hopper sidings, the busiest railway marshalling yards in Australia.

Denis Pout joined the practice in 1978 to further develop the field of heavy electrical engineering, and he and Neil Wyles, with the assistance of engineers like Ross Broadbent, have produced complex control systems for a number of major mining and materials handling projects.

Brian Mahony and Neil Wyles were appointed directors of Planner West in 1973 and Trevor Hazelwood, after eleven years of service, and Denis Pout became directors in 1980.

In July 1981 the practice merged with GHD with advantage to both firms. John Planner, Ted West and Brian Mahony were appointed directors of GHD and Neil Wyles, Trevor Hazelwood and Denis Pout as principals.

Don Skinner and Miles Pierce in Melbourne were appointed a director and a principal respectively of Planner West, while Alan Irwin, who had worked for GHD in Melbourne years earlier, rejoined the practice and was appointed an associate of Planner West. Neil Rowlands, who had been in charge of mechanical and electrical engineering for GHD in Sydney, was made
a principal of GHD and moved to Darwin as deputy project manager for the Channel Island Power Station.

In South East Asia a knowledge and sympathetic understanding of local customs and people, of the terrain and the materials available from it, are all of extreme value to any group of consulting engineers from another country.

GHD felt that extension of its practice to Malaysia would be a logical move. For various reasons, it was necessary to form an association with a local firm in order to practise in that country. After GHD had investigated the possibilities of Kuala Lumpur, Angkasa-GHD Engineers Sdn Bhd was formed in January 1978 to practise as consulting engineers and planners in fields where the combined expertise and experience of Angkasa Jurutera Perunding and Gutteridge Haskins & Davey could be utilised to provide consulting services to government instrumentalities and private clients.

In particular, it was considered that the capabilities of the new association were important in the fields of development of national resources, community, welfare, industrial, commercial, agricultural and mining projects.

The skills available from the association included a full range of engineering disciplines, together with photogrammetry and project management, plus the pool of local knowledge provided by Angkasa.

In 1985 the Chairman of the Board of Directors was Tuan Haji Muhammad Yusof bin Hindon, formerly a senior Malaysian government civil engineer. In 1972 he was honoured by the Sultan of Pahang for services to the State. Managing Director in 1985 was Woo Hin Wai, an Honours graduate in engineering from the University of Malaya in 1962. In 1972 Woo Hin Wai founded the consulting firm of Angkasa Jurutera Perunding. In 1974 Tuan Haji Yusof joined the firm as a partner, thus combining their wide engineering experience in both government and private industry.

Hans Wolfram, then a director of GHD in 1978, was a founding director of the new firm. Jim Scott, as associate of GHD, was another early director and was the project manager for a study of the water resources of the Pahang River Basin in Malaysia.

Angkasa-GHD has already been involved in projects in four of the States of Malaysia — Perak, Trengganu, Malacca and Pahang. The projects include the design of the major Ipoh Swimming Pool Complex, probably the finest in all Asia; new water supply schemes for the towns of Kuala Kangsar and Kamunting; an environmental impact study associated with the development of the Paka Power Station within a coastal area planned as an industrial complex to utilise oil and gas from offshore fields; the design of terminal buildings for the Trengganu Crude Oil Terminal; a master plan for sewerage and drainage for Malacca; the design of the Mentakab flood mitigation scheme; the extension of four separate townships in central Trengganu and the design of a new town in South-East Pahang to cover 2000 acres (810 ha).

They were all big jobs of great importance to Malaysia.

Angkasa-GHD will continue to offer services which may have important potential for the development of South-East Asia.
In 1974 GHD formed a joint company with a US firm, Parsons Brinckerhoff so that the combined expertise could carry out engineering tasks associated with urban transport systems.

GHD-Parsons Brinckerhoff Pty Ltd, or GP as it was more commonly known, undertook for the South Australian Ministry of Transport, the Adelaide Regional Transit Patronage Study, Phase I. This study included analysis and tabulation of data concerning travel in the Adelaide region, definition of subsequent activities in the patronage study and investigations related to land use planning and traffic zone information. The study was part of the development and improvement of a comprehensive regional transport system.

An important part of any transit system is its maintenance and repair facilities. For the Metropolitan Transport Trust in Hobart, Tasmania, GP provided specialist expertise and review of the planning and design by GHD for a new depot, maintenance facility and administration centre at Springfield. This complex was designed to serve as a depot for some two hundred buses, provide maintenance and repair services for the entire fleet and house the total administration staff of the Trust.

For the Metropolitan Transit Board, Brisbane, Queensland, GP developed plans for the modernisation of three suburban railway stations to make them contemporary modal interchanges in the regional transport system. The plans were based on analyses of future transport needs at each location and evaluation of local development plans, topography, services and transport facilities.

The association of Gutteridge Haskins & Davey with Parsons Brinckerhoff was restructured in June 1981, with the new name of GHD Transportation Consultants Pty Ltd, a wholly-owned subsidiary of GHD.

Also in 1981 GHD and the large United States partnership of Black & Veatch formally established a continuing joint venture to provide complete engineering and management services for power generation and high voltage transmission.

Black & Veatch was founded in 1915 and is one of the largest consulting engineering firms in the world. It is a leader in the design of power generation, transmission and distribution systems and has completed more than two thousand assignments for electric utilities throughout the world. Oddly enough, the practice remains as a partnership, as against the usual situation of legal entities as companies and groups of companies. Black & Veatch are quite proud of the fact that they are still a partnership.

The production of power in Australia does not start and finish with the erection of a power station. There are a multitude of facets to be considered including preliminary station layouts, land acquisition, sources of fuel and its transportation to the power station, tariff structures (what the electricity will cost the consumer) and the environment.

The joint venture is of great advantage to both practices and brings together experience in the electric design field by Black & Veatch, the coal transportation and handling experience of GHD and the mechanical and electrical services for
bulk materials handling of Planner West.

By 1985 GHD-Black & Veatch had already completed two significant studies in Australia, one for a State public utility and the other for a private company. In addition, in 1984 the joint venture was commissioned by the Northern Territory Electricity Commission for the project management consultancy for the Channel Island Power Station project, located in the middle arm of Darwin Harbour. GHD-Black & Veatch had previously been selected from a worldwide list of sixty-seven contenders to carry out the original consultancy which included the preliminary design of the station, detailed design of major civil engineering works and the preparation of specifications for major long-lead items of plant.

Starting with a bare ‘greenfields’ site, the consultancy covered preliminary and conceptual engineering for the proposed ultimate 300 megawatts coal-fired power station, and more detailed planning for the initial 100 megawatts installation. Specifications required the coal-fired boilers also to be capable of firing by natural gas or oil.

Detailed design for site civil works and marine facilities for coal unloading was added to the task to allow early calling of tenders for those contracts and thus provide early employment opportunities for the Northern Territory workforce.

For the final project management consultancy three other internationally reputed firms, together with GHD-Black & Veatch, were invited by the Northern Territory Electricity Commission to submit proposals. GHD-Black & Veatch won the contract.

At this stage, however, the Northern Territory government became aware of the possibility that natural gas discovered in Central Australia could prove to be a suitable fuel for the new station, and a ‘hold’ was placed on much of the work for many months while details were worked out and contracts arranged with the owners of the gas-fields for supply and transportation of the gas to Darwin.

In due course the policy decision was made to adopt gas as the fuel and,
following further consideration by GHD-Black & Veatch and the Northern Territory Electricity Commission, it was resolved to install 200 megawatts of generating capacity through a series of open-cycle and combined-cycle gas turbines.

GHD-Black & Veatch was confirmed as project manager for the gas-fired station and for detailed design and the writing of specifications for all contracts for supply and installation. The prequalification of tenderers and the letting of contracts proceeded from April 1985 on a tight time schedule for completion of the project. Norm Traves of GHD and Lee Fickle of Black & Veatch International constituted the project directorate. Ed Lemons of Black & Veatch was appointed project manager and Neil Rowlands, from GHD, his deputy. Tom Kalin was partner-in-charge for Black & Veatch. Bob Kohleppel of Black & Veatch was the initial project field manager, in charge of construction on the site, while the station was envisaged as coal-burning, and was later succeeded by Wendy Jacks for a time and then by Hal Smith through the critical construction period.

Detailed design had been carried out mainly in the project office in Darwin by personnel from both firms and in the Kansas City headquarters of Black & Veatch where two electrical engineers from GHD, Ross Broadbent and Phil Kirby, worked for several months while Neil Rowlands and others made periodic visits as required. Graham Sproats was responsible for civil and structural work in Darwin, assisted by other staff members in Darwin who subsequently moved out to the site for the construction period. Kathy Herrmann attended to local work on electrical design. Glen Truscott, the principal of GHD responsible for geotechnical engineering, Clive Wood and Philip O’Flaherty had to solve some difficult foundation problems, particularly for the ash dam originally designed for the coal station, land reclamation and the transmission line across the water and mangrove areas back to Darwin.

John Rowland and Xavier Clarke led the survey parties who established the transmission route skirting Darwin Harbour, experiencing all the usual problems and discomforts of surveyors in tidal areas of Northern Australia.

The year 1986 saw intense activity on Channel Island and along the transmission line to Darwin as construction speeded up, and the multitude of items of equipment, including the gas turbines and generators, were delivered and installed by the teams of the various major contractors.

A strong supervisory team headed by Hal Smith was built up on site, and engineers, supervisors and administration staff worked long hours to ensure that all was done correctly and that the station produced power on schedule. A notable feature was the way in which personnel from GHD and Black & Veatch worked together harmoniously and effectively and in collaboration with Owen Peake, Vladimir Chiknaikin, Peter Fowler and other engineers from the Electricity Commission, to ensure a successful outcome.

GHD provided most of the site team, including Peter Nichols (contracts), Ross Broadbent (lead electrical), Ed Heyting (lead mechanical), Barry Ridge (lead civil), Warwick Mace (personnel services), Phil Kirby (electrical), Terry Martin and Rob Meldrum (civil), John Gersekowski (structural and transmission line) and Philip O’Flaherty (geotechnical).
These were complemented by experienced Black & Veatch staff including Bill Settles (construction manager), Gerry Hart (planning/control), Steve Edwards (systems), Darryl Lees (mechanical) and Ken Ludwig (instrumentation and control).

The commission of GHD-Black & Veatch included not only the full engineering services but also the preparation of detailed operating manuals and the training of operating staff, which was carried out on site by Maurice Defeyter of Black & Veatch.

The island on which the power station was built is in itself of historical importance to Australia. Evidence has been found of traditional Aboriginal land use and of military occupation during World War II. In addition, the Northern Australian Leprosarium previously operated there. Channel Island has now been linked to the mainland and Darwin by two major bridges over an arm of the harbour and Elizabeth River.

The first gas turbine unit, after the usual testing and commissioning procedures, burning natural gas from Central Australia, was formally started up in December 1986 by Hon. Barry Coulter, Minister for Mines and Energy, in the presence of Owen Peake, General Manager of NTEC, and members of the GHD-Black & Veatch site team, to feed electricity into the Darwin grid, thus marking the first stage in the completion of this notable project. The four further gas turbines were commissioned progressively through to mid 1987.

Early in September 1987 the Northern Territory government and the Electricity Commission (now incorporated in the Power and Water Authority) held the official opening ceremonies, culminating in an Open Day when thousands of Darwin residents inspected the new station.

The official speakers complimented GHD-Black & Veatch on its achievement and referred to the station as the most technically advanced and highest thermally efficient power generation facility in Australia.

The heat recovery steam generators, operating on the exhaust gases from two of the gas turbines, and the associated steam turbine came on line as

![The plaque unveiled at the opening of Channel Island Power Station. Ed Lemons, Hal Smith, Neil Rowlands, Tom Kalin, Jim Adam and Norm Traves.](image-url)
scheduled in October 1987 and the station was fully operational.

The detailed design and construction of Channel Island had been accomplished in a period of less than three years from the decision to use gas as the fuel, within a tight financial budget of $225 million.

GHD-Black & Veatch was awarded another most significant commission, being a detailed feasibility study for a major power station (possibly ultimately 4600 megawatts), proposed by a partnership of CRA and Mitsubishi to be erected as a privately-owned power station at Oaklands, in the Riverina district of New South Wales, adjacent to large coal deposits that can be mined by open cut. The prefeasibility study for this project had been carried out earlier by GHD-Black & Veatch. Personnel engaged on this study included Peter Manger of GHD as project director, Ed Lemons (project manager) and Gary Christensen (resident study manager) of Black & Veatch and a strong contingent from the Sydney and Melbourne offices of GHD including Bill McCredie, Miles Pierce and Peter Hallows.

As it was clear that GHD-Black & Veatch had been established as a significant force in the field of power generation in Australia, the joint venture partners proceeded with the establishment of a jointly-owned Australian company, GHD-Black & Veatch Pty Limited, which came into existence late in 1985, with Allen Acheson (President of Black & Veatch International) and Norm Traves as directors. GHD and its associated organisation, Australian Port Consultants, have also worked as sub-consultants to Black & Veatch on power generation projects in Sri Lanka and Singapore.

GHD-Wood Geotechnical Pty Ltd, which is headed by Dr Glen Truscott, was established in Brisbane following the acquisition by GHD in December 1981 of Wood Geotechnical Consultants Pty Ltd, the practice of Dr Clive Wood who remains with the new organisation. Although the base of operations of the company is in Queensland, it works throughout Australia.

The aim of GHD-Wood Geotechnical is to provide foundation investigation and geotechnical services to a comprehensive range of clients, including commercial, industrial, government, mining, contracting and development groups.

The additional services which the company provides means that GHD is now better able to provide the component skills making up the complete package of services required for a multi-disciplinary project. These services include investigation, design and analyses. Investigations may be geophysical, geological, foundations, exploration, laboratory and terrain evaluation. The design factor is equally important and includes design for foundations, cuts in soil and rock, underground openings, embankments and roads. The analyses available now are particularly important and include slope stability, bearing pressures, pile foundations, settlements, seepage and subsidence.

Projects have been numerous but, surprisingly, a considerable part of the activity has been the analysis of soft ground conditions. This latter aspect has included work on the Cairns airport extensions, checking settlement
computations at Brisbane airport and foundation design on the soft ground at Kooragang Island, Newcastle, New South Wales, for a new coal loader.

Some of the projects which Glen Truscott and his team of engineers and geologists have carried out have resulted in use being made of land where the foundations are little more than mud and where a layman would expect any structure just to disappear.

In Santubong, Malaysia, the mud is more than twenty-eight metres deep and that's an awful lot of mud in anybody's language. A recently completed bridge had approach embankments more than eight metres high. Any subsidence would have caused road maintenance problems as well as serious instability in the abutment piles. An on-site model of the embankments was taken to failure, to measure directly the foundation strength and consolidation characteristics. The embankments were then designed to include an overbuild to pre-load the foundation and thus reduce future settlement.

In Darwin another project was the investigation and preliminary design of a marina at Vesteys Beach. For the project, the foundation properties of the underlying beach sand, organic marine mud, laterite and phyllite were examined. Because of a tidal rise and fall in excess of seven metres, the marina would feature a holding basin to maintain water level at low tide. The basin embankments would be constructed on soft mud and have to be stable and strong enough to withstand storm surges arising from cyclone conditions. It is also necessary to design cuts in the soft mud and embankments to retain mud during marina operations. Piles are proposed for the foundations of the marina buildings.

GHD-Wood just loves to play around in mud. At Fisherman Islands, Brisbane, the soft mud below reclaimed tidal mangrove swamp was thirty-five metres deep and ouch! did it smell! The engineers got right into that mud, examined it, analysed it, smelt it, did everything but eat it; they came up with a solution and a huge grain terminal is now sitting proudly on the previous swamp.

In July 1981, GHD, in association with Allen Vogan, established an urban property management company under the name of GHD-Vogan Pty Ltd. Allen Vogan was previously a senior executive of the Australia-wide Hooker Corporation, having held many positions with its Land Development Division during his twenty-five years with that firm.

The company acts as a consultant to private individuals, companies and organisations who, for investment or other reasons, have land or property holdings but are not themselves developers.

The establishment of this company has become increasingly important as urban development expands. The scope of management services offered by the company ranges from the assessment of development opportunities, negotiations with statutory authorities, assessment of the viability of a project, through to planning, development and marketing.
Australian Port Consultants is an excellent example, in the consulting engineering field, of maximum use of disciplines on an economic basis.

Originally the joint venture, as it was, was formed by GHD, Planner West and Alex Macknight & Associates to submit a proposal for the design of the Dalrymple Bay Coal Terminal. It was a Queensland job but the joint venture, known then as Queensland Port Consultants, was unsuccessful in the winning of the appointment.

Subsequently the group decided to offer its services under the new name of Australian Port Consultants.

The enterprise is a continuing joint venture, operating as jobs arise. The group offers formidable expertise in all work associated with port work. This may include loading, dredging, materials handling, wave investigations, construction of wharf and harbour facilities and the operational side of materials handling from loading, unloading and stockpiling to delivery. In short, the joint venture is perfectly capable of selecting an inlet on virgin coast and designing a complete port.

The group and its members have been involved in a great many projects ranging from the normal industrial works to developmental enterprises with our near neighbours. It would be tedious to list all projects involved but those of particular interest are: a study for a copper mine in Papua New Guinea; the export of coal from Oakey and German Creeks; ship repair facilities; the onshore works of the Abbot Point Coal Terminal; the Esperance Wharf in Western Australia; the port works at Darwin and the Wabo Power Station, the clients for which were the Australian, Japanese and Papua New Guinea governments. These assignments are perhaps spectacular but others bring to the fore the point that GHD and its associates continue to play a part in the industrial development of Australia.

These firms do not consider the size of a project to be its most important requisite. The range of project sizes may go from a coal loader at Barney Point, Queensland, and the APM wharf at Port Huon to the marlin jetty at Cairns where the importance was not that of enabling a capacity of, say, twenty-five million tonnes of coal per year but the handling of thousands of tourists and game fishermen and the weighing of a one tonne marlin. They provide full services irrespective of the size of the project.

Another interesting project was to design the export facilities for liquid natural gas from the North West Shelf in Western Australia. It was a challenging project in an area where tides range to eight metres, where jetties and wharves seem to stretch into the sea for such distances that transport is required to traverse them and where berths must accommodate the huge ships which carry the gas.

In the course of time Planner West amalgamated with GHD and GHD acquired an interest in Alex Macknight and Associates, now renamed Macknight Pty Ltd.

Thus by 1987 all the member firms of Australian Port Consultants had come closer together in a group with Macknight, under the directorship of Alex Macknight and Bob Rivett, handling the work of the group in the field of marine
engineering.

In 1985 the establishment of a permanent joint venture between GHD and Transmark followed a successful relationship through a series of joint ventures which had commenced in 1978.

Transmark is a worldwide consulting company, a subsidiary of British Rail. Its consultants have acquired wide transport knowledge as a result of completing projects on every continent. It has been its work with British Rail, however, which has given Transmark engineers a reputation for excellence. British Rail is one of the world’s most modern rail systems, covering more than 17,500 route kilometres with over 16,000 passenger trains and 1900 freight trains running each day.

GHD and Transmark first worked together in a group of consultants on the Main Line Electrification Study conducted for Queensland Railways in 1978, as mentioned in a previous chapter. As a follow-on to this study GHD-Transmark and another consultant worked in a joint venture in 1981 on the detailed design for electrification of the Blackwater-Gladstone line in Queensland and the preliminary design for electrification of the Gladstone-Brisbane line. The project was later expanded to include detailed electrification to Emerald. Construction is now well advanced.

Between 1981 and 1986 GHD and Transmark commenced providing consulting services in the fields of design, contract supervision and project management for the Illawarra Railway Electrification Project. The scheme was, at that time, the largest construction works to be undertaken in New South Wales for many years.

The Illawarra project included major track upgrading, tunnel strengthening, bridgeworks, resignalling and electrification works on a busy, working railway line. The efforts of the project management team were recognised when the project won an Award for Excellence from the Sydney Division of The Institution of Engineers, Australia.

GHD-Transmark Australia has worked on major operational studies for both freight and passenger trains, allowing railways as diverse as the Mount Newman-Port Hedland line and the State Rail Authority of New South Wales system to improve their business performance.

In 1986 and 1987 GHD-Transmark Australia provided services for certification as a working railway and produced operations manuals for the Skitube Rack Railway in the Snowy Mountains.

The joint venture also assisted GHD with the East Hills-Campbelltown Railway Project, providing track design, signalling and electrification design and construction assistance, as well as operations advice.

Perhaps the most exciting project was the Very Fast Train — a proposal to link Sydney to Melbourne by a three-hour train service. GHD-Transmark carried out marketing studies for the whole project and a prefeasibility study into the difficult problem of access to the Central Business District of Sydney.
The joint venture continues to offer consultancy services in all fields of railway engineering and operations, which services supplement those available from GHD itself.

In 1986 GHD acquired the practice of Fisher Shepherd in Geraldton in Western Australia, which handled local government and related civil engineering works in that area. The office of Fisher Shepherd became the local office of GHD and Paul Fisher joined the staff of GHD in Perth.

At about the same time, on the other side of the continent, in Sydney, Doug Ennis, the remaining principal of Rowe and Ennis, wished to retire and offered his practice to GHD. This was a long-established practice which had been a friendly competitor with GHD in servicing mainly local government clients in the Sydney region. The practice has continued in operation, managed by Ron Van Es from the Sydney office.

Again over in Western Australia, the established and well-reputed survey firm of Fisher Lewis was offered to GHD-Dwyer when the principals wished to retire from active practice. GHD saw the establishment of a survey practice in Western Australia as a desirable form of expansion, so Fisher Lewis became the vehicle for GHD in the surveying field in the west.

Ivan Miller, as the survey principal of GHD, undertook the overall supervision of the venture and Kevin Phillips was appointed as manager. ‘High technology’ equipment and methods were implemented, and Fisher Lewis continues as part of the Western Australia practice, with a solid workload in engineering, mining and land surveying.

GHD has provided a wide range of engineering services to Australia’s mining industry during the last twenty years. However, the range of services was expanded in 1985 through a joint venture with Wright Engineers, the well-known mining consulting group, whose headquarters are located in Vancouver, Canada.

Wright Engineers has a worldwide reputation as metallurgists and mining engineers, in addition to its capability in project management and design of materials handling systems for the mining industry. Wright Engineers has operated in Australia since 1969 and its Australian projects included the Ranger Uranium Mine at Jabiru in the Northern Territory.

The GHD-Wright joint venture has been well received by Australia’s mining companies and it successfully completed forty-one assignments during the first
two years of operation.

Phil Baily is the joint venture’s general manager and Gwyn Griffith is the principal mining engineer. Although the joint venture is very much ‘Australianised’ technical support is always available from Vancouver when required.
HELPING OUR NEIGHBOURS

O discoveries!

the landscape developing

In palm and mangrove and watercoloured plain

Hatched with canals, before the steady ship

That noses up a narrow yellow water

Under a rosy sky.  

‘In South East Asia’
J.R. Rowland (1925 - )

GHD believes it has an important and continuing role to play in Asia, not only by participation in engineering projects in the lands to Australia’s north, but in the training of local staff so that, in time, they may themselves make an even greater contribution to their own countries.

The experience in engineering project management and design gained by GHD over some six decades has great relevance to Asia and, in particular, to South-East Asia. There are similarities of needs between Asia and Australia in such fields as water, sewerage and electrification, and in many areas, similarities of conditions — desert, jungle, grasslands etc.

In 1986 the three principals of GHD mainly concerned with overseas projects were Timothy Smyth, responsible for all projects in Malaysia, and Bob Rivett and Bob Lloyd, responsible for all other overseas work. While Timothy worked from the Sydney office, both ‘Bobs’ were based in Brisbane. Henry Adcock took over from Bob Rivett in 1987.

In the 1970s GHD gained commissions in Malaysia and embarked on an association with the Malaysian firm of Angkasa Jurutera Perunding Sdn Bhd, consulting engineers. The company, Angkasa-GHD Sdn Bhd, has been described in the previous chapter.

The work in Malaysia has been so varied and so continuous that Mike Tseng of the Sydney office was transferred there in November 1981 and remained until 1984, when his place was taken by Mike Polin, also from the Sydney office.

In the face of competition from consulting engineers worldwide, GHD has been invited to work on an impressive group of projects in Korea, Malaysia, Bougainville, Solomon Islands and New Guinea, including water supply schemes, urban infrastructure design, power stations and environmental studies. The scope of the projects is visible proof of a success story which confirms the concept that Australian engineering experience and expertise adapt well to the Asian and Pacific environments and can assist those countries.

There have been many spectacular overseas projects, including one in Korea.
In December 1970 the Snowy Mountains Engineering Corporation (SMEC), in association with GHD, was awarded a contract with the Korean Water Resources Development Corporation for the Andong Multi-Purpose Dam project. This was a major achievement for Australian engineering.

The purpose of this commission, under the auspices of the Asian Development Bank, was to study the Naktong River Basin and to formulate ways and means of overcoming water shortages. The Basin covers an area of some 9000 square miles (23 000 square kilometres) and provides water for thirty million people.

The project was massive in all respects, including its potential for benefit and change to the people living in the area. For example, 30 000 people will eventually have to be relocated, an indication of the ability of the Korean people to accept change, particularly when they believe it is to be to their eventual benefit.

The dam studies were carried out by SMEC and the basin studies by GHD, under the direction of Mr K. Anders of SMEC and Albert Streber of GHD respectively.

Ken Harding, Peter Hallows and Ross Smith arrived on site at Daegu in February 1971. Robert Lloyd joined the team for two periods and was responsible for home office support, while during the second phase of the project Bernard Callinan was able to visit South Korea and review progress.

Peter Hallows took his wife and children to the site, where he lived in the compound of a British leprosarium. There were no lepers living there at the time, although two lady missionaries still used the compound as a base for their work.

The basin study required a multi-discipline effort and specific assistance
was rendered by a number of specialists. Ian Coffey of Hassall and Partners, Goulburn, New South Wales, carried out the study of irrigation and agricultural development in the basin, while Mike Saddlington from the Bureau of Agricultural Economics studied the economic and financial aspects of agricultural development. Ron Griffin, from the State Electricity Commission of Victoria, was involved with economic analysis of the project. Sandford Clarke from the University of Melbourne dealt with the legal and institutional aspects and Tom Nevins from Wellington, New Zealand, with river regulation and the effects of the dam.

The extremes of climate in Korea, with the winter too cold and the summer too wet, make construction difficult and the schedule for dam construction allowed a sequence of four months' work followed by two months of practically no work.

The Naktong River is shallow and wide like many Korean rivers, being generally only a metre or so deep but up to four hundred metres wide. It has large variations in flow.

The major task of the basin studies was to determine water requirements along the river, to evaluate the benefits from a regulated flow and to determine the optimum size of the Andong Dam. Water would be used for supplies to cities and towns, and for the irrigation of rice.

Salt water intrusion was a serious problem in the estuary of the Naktong River, and the river flow necessary to prevent saline water from entering the supplies to municipal, industrial and irrigation consumers were assessed. Levee banks had to be built to control flooding and these, in turn, produced complex drainage problems.

The project, because of its multi-discipline character, was most interesting and absorbing. One of the most gratifying aspects of the project, apart from the successful conclusion of an involved task, was the teamwork, patience and understanding of all who worked on site and were faced with the problem of establishing communications in a strange country. This teamwork had another lasting benefit to Korea as every engineer on site had a Korean counterpart to learn new skills from the Westerners.

There is a saying that behind every successful man there is a woman. This is true of the men in field operations in Korea. The team deeply appreciated the motherly help and patience of Mrs Pauline Hunter, Mrs Kay Smith and Mrs Sandra Hallows, who did so much to care for their welfare.

Korea was not GHD's first overseas project.

In January 1969 Ivan Miller, director of surveying for GHD, enjoyed an unusual history lesson. He was seated in a DC3, a comfortable old plane which snored along the route from Port Moresby to Lae, on to Rabaul and down to Kieta on the island of Bougainville. The history lesson was given by his boss, Bernard Callinan, who had seen service in these islands in 1944-45. For Callinan it was an eerie and nostalgic journey that few men have; he pointed out to Miller features of the landscape where he had soldiered with men, many of whom were now deceased.

The journey was not to rediscover battle grounds but to assist in the
development of an open-cut mine which would extract, over a period of forty years, five hundred million tons of low grade copper ore. By any standards it was a formidable task. The site of the mining operations was thirty kilometres from the coast in steep and ravine-ridden country covered with dense jungle. There was barely enough level space to build one house, let alone accommodation for three thousand mine workers.

GHD was appointed by Bougainville Copper, a subsidiary of the giant Conzinc Riotinto, to carry out the planning for two new towns. In layman’s language this meant provision of roads, drainage, sewerage, electrification — in fact, all essential services, including leisure facilities such as swimming centres, recreation ovals and community halls.

In July 1969, the sponsors appointed Bechtel as project managers and GHD worked directly with them in a very good relationship.

It was not only the terrain which was formidable; there were other problems, including the planning for integration of people with different backgrounds.

The initial surveys were difficult and laborious but were pushed through despite the constant and heavy rainfall. The government of Papua New Guinea had decreed that no expatriate labourers were to be used and, as there were insufficient local indigenous people to do the work, labourers were recruited from the surrounding islands, including many from Buka. The latter people were of excellent calibre and a real asset to the job. (The people of Buka, by the way, are said to have the blackest skins of any people in the world.) Ivan Miller, manager of the project for GHD, trained local people as survey chainmen and became well satisfied with their performance.

The mining site was so difficult that the number of residents was limited to essential mine staff and support services, about three thousand people all told; this was the town of Panguna. There were special difficulties in locating, then constructing, a village with all services, in a narrow valley with steeply sloping and heavily-forested sides and a rainfall of four metres a year.

A coastal town, Arawa, was surveyed on the site of copra plantations and was designed to accommodate ten thousand people. In a town of that size it was necessary to provide not only a light industrial area to service the town, but also a hospital, four primary schools, one high school and one technical school.

Unlike other towns in Papua New Guinea, with their roads raised above the natural surface and stormwaters being shed to deep side drains, Arawa was designed with depressed roadways, in relation to the residential land, which act as floodways to contain the major flows, with piped drainage and channels providing for the normal flows.

The facilities, as finally designed and completed, would have made councillors in many Australian country towns quite envious. The size of the total project was so large that twenty professionals and thirty technical assistants were drawn from GHD alone. Thousands of drawings had to be issued, revised if necessary and issued again. It was a team effort involving almost one hundred thousand manhours.
Subsequently both GHD and D.J. Dwyer & Associates carried out further work on Bougainville. Henry Friend and Mike Spaulding from the Cairns office of GHD did work on the sewerage system of the town of Arawa and later designed extensions to its residential areas, this work being supervised in the field by Col Angwin of the Brisbane office. D.J. Dwyer & Associates independently carried out work in Kiesta and Arawa over these years.

Later, GHD was called in by Bougainville Copper to advise on problems in Panguna, where the town by then had been extended into even steeper valleys which could be affected by flash floods in the fast-flowing Kawerong River. Norm Traves and Timothy Smyth paid several visits to Panguna to maintain an overview of remedial work on the river bed and banks, while Ken Harding from Sydney attended to detailed work on site.

GHD has regarded the Bougainville projects as a major contribution to the development of the area north-east of Australia.

In early 1976 Bob Goakes, still managing GHD’s Cairns office, was asked by the National Works Authority of Papua New Guinea to carry out an erosion study for the beaches at Wewak, and subsequently a planning study for Wewak.

The erosion problem appeared to be quite serious. The coastal road was in danger, it was thought, of becoming unusable due to erosion and, if this happened, serious dislocation of transport and communication between the town, the port and the main army barracks would result.

Norm Traves, Rob Harrap and Leon Fleming visited Wewak along with Brian McGrath, an erosion expert from the Department of Harbours and Marine. Harrap and McGrath prepared a monitoring/investigation program to assess the physical processes operating on the beaches, e.g. tides, wave heights, currents, beach profiles.

Rob Harrap spent five weeks with surveyor Bruce Keable, from the Cairns office of GHD, setting up the investigation work, which was continued by the National Works Authority for a fifteen month period in 1976-77. The investigation was in-depth in every sense of the word; beach profile surveys were made every six weeks, assessing tides and related currents. Wave heights and soundings off the beaches were taken daily and beach sand was sampled and tested.

Harrap, who had only joined GHD in 1970, was an engineer with experience in coastal management and canal estates. He recommended remedial measures to combat the erosion, including a sand replenishment programme.

Leon Fleming, a GHD engineer/planner, updated the previous plan for the town, looking not only to population projections to the year 2000 but to the development of the town itself. It was not a straightforward project; Fleming had to plan for the reclamation of a large swamp adjacent to the town post office, including a grading and survey plan, and to provide an estimate of the cost of the project.

Other studies in Papua New Guinea included the problem of erosion at Kerema, west of Port Moresby, and similar problems at Lae and Aitape.
The projects were of great interest to GHD engineers, probably because of the cultural and physiographic differences between Papua New Guinea and Australia. The proposals for Kerema, for example, involved a town built at the entrance of a very mobile river delta.

Sarawak has had a long history of conquest and of fierce internecine fighting.

The Island of Borneo is about three times the size of Great Britain. The Portugese and Spaniards fought over and traded with Borneo for spices in the sixteenth century, but were ousted by the Dutch in the seventeenth century and Borneo remained under Dutch influence until 1949.

One of the four political divisions of Borneo, Sarawak, was set up as an independent principality under Sir James Brooke by the Sultan of Brunei. Brooke, who was later known as the ‘White Rajah’ of Sarawak, was given hereditary rights to the Territory. Most things change; the Brooke family has gone and Sarawak, while still a physical part of the island of Borneo, now belongs to the Federation of Malaysia.

Sarawak has not had its roads and communications upgraded as fast as some other areas of South-East Asia but perhaps there was not the urgency then that there is now. Until comparatively modern times the area was sparsely populated and the rivers were veritable highways in their own right.

With the growth of population and the necessity for better roads, GHD has played a major part in developing communications in this jungle-clad country through its bridge-building programme.

The programme began in the early 1970s with a visit to Sarawak by Bob Goakes to inspect the site of a proposed bridge. The site was only one hundred metres from a graceful ‘Golden Gate’ style suspension bridge which had been designed by a lady engineer in 1906, more than sixty years previously. The bridge was of steel and in excellent condition, but its usefulness as a means of communication had long disappeared and its capacity to take heavy loads was limited to the weight of a jeep.

Goakes returned to Australia and GHD was able to make an offer of professional services to the Federal government, which was accepted.

Whilst in Sarawak, Goakes was amazed at the skill of the local engineers, many of them of Chinese extraction, in production of prestressed concrete. ‘Their skills’, he claimed, ‘were quite unusual, but they had not had the experience to make the maximum use of concrete in such applications as bridges.’

The first major project was a prestressed concrete bridge in Kuching. It was to be a vital link between two growth centres in the city. It is an imposing bridge with an imposing name. It is officially known as the ‘Datuk Patinggi Haji Abdul Rahman Yakub Bridge’ in honour of the then Chief Minister.

The bridge is no mean structure; it has four lanes and is 440 metres long. It comprises post-tensioned segmental box girders over the four main 50-metre spans and two 38-metre spans with prestressed precast beams for the six 27-metre approach spans.
Sometimes the culture shock to the people of such areas, from the introduction of modern communications, is almost too much for them, although Timothy Smyth, in charge of Malaysian operations for GHD, did not quite see it this way. He recalled visiting the house of a local headman and in pride of place on the mantelshelf next to some shrunken heads was a battery-operated television set. The batteries were recharged each week during a weekly visit to town.

The building of the bridge was not without a certain impact on some of the local headmen. In much the same way that a fir tree is placed on the top of a newly completed building in Scandinavian countries, in days now long past the people of Sarawak had always thought it a good omen to toss into the foundations of a new building a human head. There were obvious advantages in the custom inasmuch as it was almost always the head of a member of another tribe. Thus this simple rite reduced the number of potential enemies and appeased the gods.

The local people, of course, no longer follow those customs or believe in them. It was odd, though, that when the sockets were being excavated into the rock to form the bridge's foundations, the attendance at the town’s picture theatres, all evening shows, dropped by fifty percent. One should never take a chance!

This important job was under the direction of Henry Adcock. On its completion there followed the designing of a standardised bridge system for use on arterial and rural roads. For this purpose a series of standard concrete units, including prestressed concrete beams up to eighteen metres, was developed and these could be combined in a variety of patterns to span smaller creeks. The work was financed under the Colombo Plan and administered through our Commonwealth Department of Works.

One of the underlying aims of the system of aid, however, is to teach the local people how to carry out these tasks themselves. To assist local personnel to gain experience in this type of work, Rod Crockart was seconded to the Sarawak PWD and trained the PWD staff in the casting of units and the operation of a precasting factory. The factory, which was also designed by GHD, was prefabricated in Australia and erected near Kuching. Crockart also provided technical support to the contractors building the bridges.

A second commission tackled the problem of the bridging of larger rivers and developed beam units of up to twenty-seven metres long consisting of three segments, cast in the factory and then assembled and post-tensioned at the bridge site. Five bridges were designed incorporating the new units in various combinations with the smaller units already available. At this stage the local technical assistance role was undertaken by Grahame Bruce, with continuing inspections and design support from John Phillips.

The third commission was for foundation investigations for six bridges over major waterways on the national highway. This included both drilling and seismic survey. The spectacle of GHD staff swinging the sledge-hammers which created the sound was too much for local onlookers, who couldn't work out why these crazy Europeans would want to bang away at the ground and
then walk away having made no observable gain from their efforts.

One of the bridge sites investigated was at Sungei Santubong, a major waterway carrying large numbers of trawlers and miscellaneous river traffic. A bridge was designed for this project, involving ship-impact resisting piers and spans of sixty metres using segmental post-tensioned box girders.

This last design then completed the upgrading of local concrete technology, initially from concrete bridges designed and built by foreign companies, to bridges built by local companies from factory-built simple units, to site-assembled and post-tensioned major units and finally to site-fabricated post-tensioned units with complicated construction procedures. In this way the local engineers and contractors gained training and experience in concrete bridge construction techniques currently being used in Australia.

GHD can be proud of its efforts in Sarawak. Its engineers not only made a major contribution to the traffic and communication systems of the State, they left behind them a well-trained group of technicians who will further assist in the development of their country.

In 1971 floods on the Pahang River in the least developed of the Malaysian States, were even more severe than normal. The inhabitants of the river basin had been settling down and planning for the future after a particularly disastrous flood in January of that year, when a second flood occurred — this time in December — causing further destruction of houses, towns and agriculture.

Pahang has always been subject to flooding of varying intensities. In some areas the inhabitants could expect heavy flooding about every twenty years, in other areas every five years, and in others more frequently than that.

The 1971 floods were so disastrous that in June 1972 the subject was broached by the Prime Minister of Malaysia to Sir William McMahon, then Prime Minister of Australia. Sir William was on a State visit to Malaysia at the time. The Australian government resolved to assist Malaysia as part of its Colombo Plan assistance by financing a study into the total water problem in the Pahang River Basin.

A study of this kind could not be limited to one of simple flood mitigation. The total project needed to include dams, storage areas for floodwaters, river diversions, roads to be built or diverted, water supply, agricultural development and, with the latter, the delicate matter of resettlement of sections of the population. The Commonwealth government commissioned GHD, the Snowy Mountains Engineering Corporation (SMEC) and Sinclair Knight & Partners (SKP) to study the project and prepare final plans.

Sir Bernard Callinan, as Managing Director of GHD, was a member of the appraisal team which arrived in Malaysia on 26 July 1972. The area covered by the study was twenty-five thousand square kilometres, a quarter of the Malay Peninsula. By September 1972 the appraisal report was completed and, as anticipated, aspects of the report included measures involving not only engineering work but other areas which resulted directly from the proposals made. For example, it was estimated that the implementation of the proposals would affect large areas of land, necessitating
the ultimate resettlement of approximately twenty-five thousand people.

The GHD team was under the directorship of Albert Streber. The total staff on the project included engineers and technicians from GHD, SMEC, SKP and local staff, and numbered about fifty at its peak. Some thirty of the staff were based in Kuala Lumpur, travelling frequently in the field. It was a compliment to GHD that Jim Scott, an associate of GHD at that time, was appointed to lead the whole team. Extensive portions of the project were performed by GHD senior engineers Peter Hallows and Ken Harding.

Scott remained in Malaysia for a period after completion of the study to assist with the arrangements for the new firm of Angkasa-GHD.

Such a huge project could not be completed in a short time so it was planned to establish, as a matter of urgency, a flood forecasting and warning system to be operative during the 1972-73 and 1973-74 monsoon seasons.

One of the greater problems, and there were many, was to survey the huge area in order to prepare the initial contour maps. Aerial photography was used but the sensitive Malaysian government, having suffered terrorists for years, was reluctant to allow photographs to be sent to Australia for processing. They were well aware that aerial photographs naturally pinpointed areas of defence, such as ammunition dumps, barracks, army posts, etc. A compromise was eventually reached under which areas of strategic importance were cut out of the photographs. This, of course, illustrated perfectly every military installation of importance in the Pahang River Basin!

The ground surveys were a triumph of achievement for the four surveyors, Colin Plumb, Allan Spowers, Ed Young and Geoff Cameron, the latter two spending eleven months at the site.

The surveyors recruited local assistants to help them hack their way into what was, in many cases, primeval jungle. The rain, insects, leeches and extremely difficult terrain placed a heavy strain on the staff. Ivan Miller, director of surveying, made two visits to the basin to coordinate the work of his survey team. Despite the difficulties, the team finally produced flood maps from the combined efforts of the ground surveys and the aerial photographs. These maps were prepared to delineate areas which would be covered by floods of varying intensities.

The lack of daily rainfall records was a major problem in planning for flood mitigation. Hydrologist Tom Fricke recalled that he was given monthly readings to the last century and, as the records gave the highest daily record of each year, it was clear that daily records had also been taken over the same period. In response to his requests for these daily records, he always met with the reply that ‘all records were burned by the Japanese during World War II’.

In preparing plans for flood mitigation, Fricke and other team members taught local residents throughout the basin to take daily rainfall readings for him, no mean feat where illiteracy was quite high, and to inform the control post by telephone where possible when the rainfall exceeded the measuring gauges’ capacity.

The Malaysian ‘troubles’ were still fresh in the local inhabitants’ minds in 1972 and, in addition, the local police were well aware of terrorists’
activities. It was therefore understandable that the locals were reluctant to venture out at night, no matter how great the downpour, to telephonne Fricke of rising river waters.

One night when Fricke realised the importance of a deluge he was unable to persuade locals to assist him with the erection of his flood measuring devices, so he enlisted the assistance of his wife to set up the apparatus on a bridge over one of the main tributaries of the Pahang River. The equipment included searchlights and the security police descended on the pair in torrential rain; it was only after some fast talk by Fricke that the couple were not locked up in the local caboose for the night as spies. The postscript to this segment was that the information obtained by Fricke and his unpaid assistant enabled him to complete his flood control report for that area.

GHD spent time training the local residents in many aspects of the project, including the training of chainmen and data collectors. Selected Malaysian personnel employed on the project received intensive coaching to enable them not only to implement the recommendations of the final report, but to develop the resources for similar studies in other areas of Malaysia.

The total massive project was eventually completed and summarised in 1974.

Another Malayan project concerned the town of Kuala Kangsar, situated in the central district of Perak State. It draws its water supply from the nearby Sungei (River) Perak. In 1979, Angkasa-GHD was commissioned by the Public Works Department to design and supervise the construction of an 11.3 ML/day water supply scheme comprising river intake structure, treatment plant, raw and treated-water pumps, reservoir and pipelines, as part of the New Kuala Kangsar Water Supply Scheme — Phase 1. The scheme was to supplement the existing water supply to the town and its environs to provide an adequate supply for its needs up to the year 1988.

The catchment draining to the Perak River is mostly tropical jungle with some areas, generally along the State's main roads or adjacent to the river, and on the shores of Chendoroh Lake, cleared for cultivation. There are some small-scale logging operations within the upper Perak River basin and also some, but not significant, tinmining activity.

Analyses of the raw river water over a number of years indicated wide-ranging values of colour, turbidity, suspended solids, temperature and iron and arsenic content. Although unacceptably high levels of arsenic were recorded in the river water at times, it was also found that the arsenic was in pentavalent form, making it removable by conventional methods of coagulation and sedimentation using alum and polyelectrolyte.

The water treatment plant designed by A-GHD comprised a chemical mixing chamber, flocculation tanks, horizontal flow sedimentation tanks and rapid gravity sand filters, and the treated water was to be finally dosed with chlorine and fluoride. As a further safeguard, an arsenic monitoring device was to be installed to analyse samples of treated water, to ensure that the arsenic level in the water supplied to the town was within an acceptable limit. For this, the first water treatment and water supply project undertaken by
Angkasa-GHD, GHD Australia seconded an engineer from its Brisbane office, Bob Crane, to act as project manager during the investigation and design stage, and Bob Macintosh was GHD’s responsible principal. The designs and documentation were mainly carried out by local engineers and staff under the project director, Woo Hin Wai.

Later, during the construction stage, the work was supervised by local resident A.L. Phang and GHD’s Mike Tseng took on the role of project manager. The construction of the scheme comprised six separate contracts, all administered by A-GHD.

Malacca or, as it is written in the Bahasa spelling, Melaka, is one of the oldest settled areas within the Malay Peninsula. It was established on the west coast of the peninsula at the mouth of the Melaka River and is about two hundred and fifty kilometres north-west of Singapore and about twice that distance from the equator.

The Strait of Malacca is an extremely busy waterway, operating almost as an inland sea. The port facilities of the city daily receive and discharge cargoes.

The city is a major tourist attraction, with its red-painted church and town hall (the ancient Dutch Staat Hus), the old Portuguese fortress — what tales it could tell! — and the beautiful old shop houses along Jalan Tun Tan Cheng Lock. Already a city of two hundred thousand, it is conservatively estimated that the population will reach four hundred thousand by the turn of the century.

The bar to the expansion of the city was the lack of a sewerage system and the Malaysian government in 1981 commissioned Angkasa-GHD to report on suitable sewerage and urban drainage schemes. Alan Longstaff and Henry Friend prepared the inception report. John Murray was the project manager, with specialised input by Tom Fricke (urban drainage), Jonathan Crockett (wastewater treatment) and Ross Smith (sewage collection system).

The phasing out of the night soil (bucket) collection system, due to the difficulty in obtaining labour, had led to sole use of septic tanks for the treatment of sewage from the urban area. In many cases, due to lack of space, the tanks were undersize and discharged directly to the urban drains, causing high levels of pollution in both the drains to the river and to the Strait. The master plan for sewerage covered five independent drainage areas, each with its own wastewater treatment plant. Initially all plants were designed for facultative lagoon systems but provision was made within the catchment of the Malacca River for later installation of oxidation channels.

The master plan for urban drainage included a proposal for the construction of a three thousand metre long river diversion to the west to eliminate significant future urban floods, mitigate rural floods and minimise interference at all times to the efficient operation of the sewage collection system.

The implementation of the project will ensure that Malacca will enjoy a healthier standard of living for its people, and will continue to delight an ever increasing number of tourists with its special charm.
Ipoh, the capital of the State of Perak in Malaysia, is centred in the area of many tin mines. It has a population of about four hundred thousand. The town is situated in the hinterland, well away from the seaside and, except for existing private club pools, there were no public swimming facilities prior to 1980.

In that year the Ipoh Municipal Council decided to provide the town with its first aquatic centre. It was to be designed for both recreation and competition purposes and to provide local swimming bodies with the opportunity of launching into teaching and training programmes, not only for school children but also for members of the community. The decision would also make Ipoh the first town in the whole country to have aquatic facilities in keeping with modern and progressive trends in the sport of swimming, and the proposed complex would become a centre for international events in swimming competitions.

Angkasa-GHD was commissioned to undertake the role of principal consultants in the design and implementation of the project at the end of 1980. The designs were carried out by local engineers and staff, with technical advice and overseeing provided by GHD’s senior staff well experienced in swimming pool designs and construction. Mike Tseng, from GHD Sydney, acted as ‘remote’ technical adviser during the design stage of the project. During the early stages of construction he was seconded from GHD in Australia to Angkasa-GHD and became its manager, based in Kuala Lumpur. While there, he was the project manager for the complex and saw the project to its successful completion.

The complex features a full-size fifty metre eight-lane championship main pool and a diving pool with a ten metre high diving tower with intermediate platforms and springboards. It also includes a full-size water polo pool, a learners’ pool, a children’s pool and a fountain pool for toddlers. Adjacent to the aquatic area is a grandstand for three thousand spectators, spacious landscaped grounds which include a children’s recreational area complete with playground equipment, a cafeteria with seating for two hundred people, an administration block consisting of offices and conference room, kiosks for snacks and drinks, spacious changerooms with toilet/shower facilities and a three hundred-vehicle car park. At night, the pool area is illuminated by high mast lighting designed for colour television telecast.

A water circulation system and water purification plant using rapid gravity sand filters keeps the filled pools clear and sparkling.

The complex was opened to the public on 1 October 1983. It proved very popular with Ipoh residents and within a short time the Ipoh Municipal Council asked A-GHD to submit proposals for siting a leisure pool and a wave pool within the existing grounds, to further improve its attractions and provide less crowded aquatic facilities for patrons using the complex.

The Pahang River Basin Study in which GHD was involved in the early 1970s covered towns and areas subject to flooding. One of the more important towns covered in the study, Mentakab, has high ground encircling it and was found to be the easiest to protect. Thus, in 1980, the Drainage and Irrigation
Department of the State of Pahang commissioned Angkasa-GHD to undertake the preparation of designs and documentation for the scheme.

Despite the surrounding high ground at Mentakab, floodwaters could enter the town at two main areas and, to a lesser extent, via a couple of saddles. The designs for the scheme comprised the building of some 1700 metres of earth bunds, some of which extended 7.5 metres high, two concrete spillways totalling 137 metres in length, automatically operated penstock-gated outlet conduits, and two large pumping stations for discharging stormwater collected within the bunded areas during periods when gravity discharge is not possible due to high river levels. The pumps are designed to cope with 1-in-10 year storm flows within the bunded areas.

GHD Brisbane’s Lindsay Monteith was seconded in early 1981 to undertake the role of project manager and main designer of the scheme. His involvement in this, as well as other A-GHD projects, resulted in his original six-month stint in Kuala Lumpur being extended to two and a half years. Again Woo Hin Wai was the project director and the team included other local engineers and support staff.

In 1980 GHD engineers in the Sydney office designed major structures associated with the $300M Khao Laem Dam project in Thailand on the Quae Noi River, one hundred and fifty kilometres upstream of the infamous ‘Bridge on the River Kwai’.

The Snowy Mountains Engineering Corporation appointed GHD as consultants for review of hydraulic design, structural designs and the tender documentation for the dam spillway and power intake structure. Ken Conway, GHD project manager, visited the site which is three hundred kilometres north-west of Bangkok.

The spillway for the dam is a gated concrete chute with a capacity of 3200 m$^3$/s. About two hundred and fifty metres long and thirty metres wide, it terminates in a bucket structure which flips the discharge into a plunge pool to be excavated in rock.

The power intake block is a concrete gravity structure, about forty metres high, containing three power intakes and an irrigation intake. Installed capacity of the power station is 300 MW. The irrigation outlet discharges into the centre of the spillway chute at mid-height.

The concrete-faced rockfill dam embankment adjacent to the power intake block is retained by a forty metre high mass gravity wall which is subject to both axial and transverse rockfill loading.

John Alden and Norm Long carried out the structural design, Andrew Kemp and Ken Harding the civil and hydraulic designs, and Bob Austin constructed a large model in polystyrene which aided project design considerably.

The lower waters of the dam were to cover much of the route of the wartime Burma Thailand Railway, built at incredible cost of human life. At the top end of the dam, waters can lap the area where the unfortunate prisoners of ‘F’ Force worked and died in 1943. Of a force of six thousand Australian and British soldiers, forty-four percent died from the effects of
overwork, malnutrition and disease in a period of eight months. It is probably most fitting that Australians have been assisting in bringing life, through water, to the country where so many Australians died.

Another very challenging project in Thailand was carried out by GHD in a joint venture with Alex Macknight and Associates, in 1984-85. It was a feasibility study for the establishment of a coal unloading facility on the east coast of Thailand at Ao Phai, about one hundred kilometres south-east of Bangkok. This location was at the site of the first black-coal-fired power station proposed for Thailand. Thailand at that time generated power from its own resources of lignite and natural gas and imported oil; it has no natural resources of oil or black coal.

The study included all aspects of establishing the port, the unloading system, the storage and the reclaiming system to feed the powerhouse. The scheme envisaged an area reclaimed from the sea in front of the power station on which the storage area would be located. The study included geotechnical investigations, civil and drainage aspects, navigation and dredging works, a long jetty and berth as well as coal handling and transporting systems. The scheme was developed so that it could be used for the transhipment of coal to other users, including another power station.

An important project in which GHD was involved as subconsultants to Black & Veatch International was a feasibility study and preliminary design for a proposed coal-fired power station at Trincomalee on the east coast of Sri Lanka.

Australian Port Consultants handled the marine and coal unloading aspects of the project including the geotechnical investigations. Black & Veatch International were the overall consultants for the entire power station study, thus carrying overseas the relationship between GHD and Black & Veatch established in Australia.

Trincomalee has one of the world’s finest harbours and its development for commercial activity commenced only in the early 1980s.

The project encompassed the investigation of several possible sites for the establishment of a power station and an unloading terminal. Following the selection of the most suitable site a detailed study was made of that site and preliminary design prepared for the approved arrangement.

GHD is committed to providing its services to countries outside Australia, with an emphasis on the training of local engineers and staff to handle their own engineering tasks in the future. The system has worked well and if, by their effort, our neighbours have gained more expertise, then the directors of GHD are well satisfied.

The projects mentioned above are only a sample of GHD’s work overseas but are sufficient to illustrate what GHD has done and is doing. The variety of projects carried out has ranged from river improvement schemes in Iran to water treatment in Sarawak, sewerage schemes in Fiji and many others. There will be many more.
ORGANISATION, MANAGEMENT AND THE FUTURE

It was fairly easy for A. Gordon Gutteridge to make a proposal on an engineering project in 1928; he was the only person concerned. When Davey set up his shingle, when Don Dwyer did so, and later John Planner, it was equally simple; they sought projects they could handle themselves and made the decision as to whether they would submit a proposal to the client.

It’s a lot different now. Davey saw the first problem area just after World War II when GHD began to employ clever young engineers who worked for experience and hoped for good salaries in the future. However they were not meshed into the partnership and did not receive a share of the profits, yet they gave GHD total commitment. Davey saw that, with the widening of their experience, other consultants could tempt his best men away and, in fact, some of his engineers did resign over the years to seek different fields.

At the end of World War II Davey was the sole principal. Both Gutteridge and Haskins were deceased and, although Davey was in some ways in a good position — he was head of an expanding firm — he was quite vulnerable because his strength lay with the quality of his engineers and the length of time they were prepared to remain with the firm. The position was made a little more tenuous perhaps than one would normally expect because Davey chose his own staff and the engineers he employed were the very best offering. Other firms were inclined to be somewhat envious of the quality of GHD staff and frequently, and sometimes successfully, made overtures to them to transfer.

Davey decided to place a little permanence into the firm in 1946 when he offered associate status, senior and junior, to seven of his top staff. The senior associates were Callinan, Keays, Trench and Inglis, with Elliott, Machin and Philip Scott appointed as junior associates.

He went further and divided the practice into geographical areas and at the same time made Jim Trench responsible for all surveying work. The development of the practice in Victoria and Tasmania was given to Bernard Callinan; John Keays was made responsible for work in the State of Queensland whilst Davey, assisted by Ken Inglis, remained in Sydney, the head office of the firm. Overall, Davey was still in sole command but the associates were given a right to share in the surpluses generated, if any.

In 1948 Davey saw the necessity to further strengthen the practice and he appointed the then associates as partners, retaining for himself the position of governing partner.

In 1964 Geoff Davey retired and the following year new partners were admitted — Ben Fink, John McCann, Alan Strom, Norm Traves and Bob Rivett. After the retirement of Geoff Davey, Ken Inglis was elected to chair the meetings of the partners. This position remained until the incorporation
of the new company. In 1971, the legal entity of Gutteridge Haskins & Davey Pty Ltd was created.

Ken Inglis and Jim Trench retired in 1971, all remaining partners became directors and Bernard Callinan was appointed Chairman and Managing Director. At the same time, three new directors were appointed to the Board — Ivan Miller, Roger Smith and Hans Wolfram. In 1978 Sir Bernard Callinan retired after forty-four years of service. His retirement followed a decision by the Board of Directors, carried on from the previous Partnership Agreement, that all directors should retire at the age of sixty-five years.

Sir Bernard continued his active life after his retirement from GHD. One of the most important perhaps, or at least one of the most prestigious of his post-retirement activities, was his chairmanship of the Parliament House Construction Authority.

On 13 December 1984, at a graduation ceremony at Monash University (Melbourne) Sir Bernard was awarded the degree of Doctor of Engineering (Honoris Causa) for his services to the engineering profession.

On Australia Day 1986 Sir Bernard was given one of the highest Awards in Australia; he was made a Companion of the Order of Australia.
The election of a chairman of directors and a managing director following Sir Bernard's retirement was an indication not only of the directors' belief in the judgment and integrity of Sir Bernard, but of their belief that 'office politics' should not enter into appointments at GHD. The Board decided not to choose a successor to Sir Bernard but to ask him to recommend a successor. Sir Bernard interviewed each director separately and finally made his report to the Board. The recommendation was to appoint two people, not one, to hold the positions of chairman of directors and managing director. The Board accepted his views without question. Sir Bernard's recommendation for the position of chairman of directors was Bob Rivett, and for the position of managing director, Ben Fink.

Bob Rivett was a Bachelor of Science in Engineering, a Bachelor of Engineering (First Class Honours) and a Master of Engineering, all degrees from the University of Queensland. He began with GHD in 1955 and was successively engineer, senior engineer, partner and director. He was the manager of the Brisbane office when promoted to the position of chairman of directors in 1978.

Bob Rivett was not the most senior in years of service to GHD but his appointment to the position of Chairman of the Board should not have been all that surprising. Bob entered the field of consulting engineering as a deliberate choice following his years in the Army, with local government and with Queensland Contractors. He had been instrumental in setting up the Technical Committee in 1967 and had remained its convenor. This committee had, as its broad objective, the consolidation and coordination of technical effort throughout the organisation. He had been quick to recognise changes in practice conditions and to conceive and initiate management action to cope with the changes, and this assisted in carrying GHD in Queensland successfully through the significant economic downturns of the middle seventies.

Outside GHD, Bob had been deeply involved in the affairs of the engineering profession. He had been either a councillor or a member of the Division Committee of The Institution of Engineers, Australia continuously for twenty years when he was elected President in 1976.

In looking at the appointment of Ben Fink as managing director, an outsider would be inclined to believe that it was not so much a sudden change in the management structure but a confirmation of a situation which had been built up very gradually over a period of years.

For some years prior to the retirement of Sir Bernard Callinan in 1978 the reputation of GHD and its staff had been growing. Governments and authorities called upon GHD for advice and assistance and an Australian company, interested in Australia, cannot refuse such invitations. It fell to Sir Bernard to bear the heat of most of this representation. He was asked to accept appointment to the West Gate Bridge Authority, to this board and to that board, to offices of his church and, finally, to the position of chairman of the authority commissioned to design and build the new Parliament House in Canberra.
Ben Fink, the man on the spot, gradually found himself virtually running the Victorian operations and anticipating many of Sir Bernard’s directions, then heading the Victorian/Tasmanian practice and latterly playing an important part in the structuring and management of the national practice. Fink had joined the Melbourne office in 1948 after qualifying as a Bachelor of Civil Engineering at Melbourne University in 1946. He worked as an assistant engineer for the Country Roads Board in Victoria but was attracted by the opportunities for experience with GHD and began there the following year. He had also been involved in the affairs of his profession. He served for many years as councillor of The Association of Consulting Engineers Australia, of which he was president in 1979-80. He also held office in The Institution of Engineers, Australia and the Victorian Local Association of the Institution of Civil Engineers. Ben, an unassuming man with a tremendous dedication and a capacity for a large volume of work, was probably quite surprised at his appointment as managing director. He should not have been. Sir Bernard Callinan knew exactly what GHD required in a managing director and made his recommendation accordingly.

A significant change in methods of operation had taken place in 1971 with the formation of three Regional Boards under separate chairman.

The first Board covered New South Wales, the Australian Capital Territory and South Australia and was under the chairmanship of John McCann. John relinquished the chairmanship of this Board in 1983 ‘to allow a younger man to take over’ and Roger Smith was appointed in his stead.

John McCann retired on 1 July 1984 after thirty-seven years of continuous service to GHD. His work with the company covered a range of special engineering accomplishments and he spent years in country areas of New South Wales introducing a variety of civil engineering projects. For a time John was manager of the fledgling office in Darwin and in later years was responsible for the administration of the overseas (other than Malaysia) activities of the company. He was keenly interested in the provision of leisure centres for young people and engineered a number of swimming centres, establishing for GHD a reputation, still maintained, as swimming centre consultants. John himself had been a competition swimmer as a young man.

Despite his heavy responsibilities and workload arising out of his position with GHD, John was always prepared to share the burden of civic and professional duties. He served as an alderman of Willoughby Council, was a trustee of the beautiful Lane Cove River Park and a member of other boards and clubs including Lloyds Register of Shipping.

In his professional life, apart from GHD responsibilities, he managed to find time to sit on the Board of Trustees of the Water Research Foundation, was an executive of the Australian National Committee of the International Association of Water Pollution Research and Control and a committee member of the Australian Water and Wastewater Association. For a period
of twelve years before he retired John was active and held various offices in The Association of Consulting Engineers Australia.

John McCann died on 22 July 1985. His Requiem Mass at Our Lady of Dolours Church in Chatswood, New South Wales was like an ecumenical service. Friends and visitors attended from the Baptist and Anglican churches, from the Church of Christ, the Uniting Church and the Salvation Army. All had been touched in some way by this fine man.

The second Board covered Victoria, Tasmania and Western Australia under the chairmanship of Ben Fink, and the third Board, covering Queensland and the Northern Territory, was under the chairmanship of John Keays. John Keays, whose work with GHD is laced throughout this book, retired in 1974 after forty-one years service and his place as chairman was taken by Norm Traves.

Two additional Boards were formed, one covering Western Australia and the other for a service area rather than a geographical one. The latter Board was GHD-Planner West, which had the responsibility for the technical discipline of electrical/mechanical and materials handling for the GHD Group. GHD-Planner West now functions as a division of the Group without a separate Board.

An important feature of the management structure has been the introduction of local offices and specialist groups.

Within each Board area small offices, dozens of them, have been set up to provide an ‘on the spot’ consultative service. The offices are sometimes manned by one engineer only, but their worth has been demonstrated by the close relationship with and understanding of local people and local needs. The offices have built up a mutual respect between GHD and many of its clients which would be difficult to achieve were all projects to be directed from capital city offices.

A further expansion of service to clients has been introduced by the creation of Expert Divisions, each headed by a principal who is highly qualified and experienced in the relevant field. By the end of 1985 there were seventeen such divisions, ranging from plant engineering to dams, from sewerage systems to mechanical services for buildings, and from planning to instrumentation and control. The extensive range is necessary to serve the very broad scope of the practice whilst applying a high level of modern technology. The divisions, through the specialist staff members, provide internal and external consultative services and ensure that the practice maintains its technological excellence and reputation in a rapidly changing environment.

Where circumstances have warranted change it has been GHD’s policy to form amalgamations, associations or joint ventures with appropriate local or overseas practices which offer complementary expertise, or to establish geographical or technical practice entities.

A management committee of directors representing Regional Boards and functional Corporate responsibilities meets monthly to deal with overall administration and ongoing activities of the GHD Group, with all directors
meeting twice a year.

On 1 July 1986 the management personnel involved in GHD changed from what had been a fairly stable position since the retirement of Sir Bernard Callinan in 1978.

The chairman of the Board, Bob Rivett, requested that he be allowed to step down from his position and resume his first love — project direction. Bob had presided over many strategic developments during his term of office, including a complex research and study programme to produce the GHD Strategy Plan. The plan was a major initiative and will be invaluable in guiding the future development of the practice.

Ben Fink was elected as the new chairman on 1 July 1986. Henry Adcock, one of the younger men in GHD, was appointed as the new managing director. Henry retained his responsibilities as director — technical services and for GHD’s development in North Queensland. Roger Smith, Regional Board chairman of NSW/ACT, was elected to the role of deputy chairman. In other management changes John Phillips assumed the position of Regional Board chairman in Western Australia and Peter Manger became the chairman and manager of the Victoria/Tasmania Regional Board and manager of the Victorian practice, roles formerly held by Ben Fink. Ray Rose, in Brisbane, succeeded Norm Traves as manager of the Queensland and Northern Territory
region. Norm Traves continued as chairman of the Queensland and Northern Territory Regional Board and director-in-charge of the Northern Territory. With John Planner, representing the mechanical, electrical and plant engineering disciplines, and Don Dwyer, responsible for corporate business development and urban and environmental planning, these directors constituted the Management Committee.

Trevor Saunders succeeded Fred Stapleton as company secretary in 1981 and became responsible for corporate administration and finance for all entities in the GHD Group and the several joint ventures and jointly-owned companies.

GHD has tried to plan its future, but the future can never be captured beforehand. The firm has adopted a strategy plan to guide it into the future and has a corporate philosophy which is shown in Appendix 4. I doubt that this will ever be broken and, if this is so, the adopted philosophy will always set standards of ethics coupled with technical excellence.

In one way the future of GHD was fixed almost sixty years ago. The principles laid down by the three men, Gutteridge, Haskins and Davey, are still the lifeblood of the practice: provide services of the highest quality to all who request them irrespective of the size of the project; support your staff — they are the practice; do not sacrifice quality for price.

At date of publication, GHD is owned and managed by thirty-eight principals covering a balanced profile of age, technical expertise and management capability. Each principal has spent a considerable period of his professional life with GHD developing as a consulting engineer. Principals are completely dedicated to the practice without any outside commitments which may create a conflict of interest in respect of clients, the practice and their profession.

The capital of a professional services organisation such as GHD is in its people. The maintenance, development, and reflection of its capability and reliability is through its principals who own and manage the practice. This is achieved by forward planning and judicious selection for succession. GHD in sixty years has kept pace in the change of engineering practice in a period which has seen the mattock at one end and the megabyte at the other. I believe it will not only accept change, it will, as it has done so frequently, make change.

However, pursuit of the corporate philosophy will ensure the practice maintains its premier position in providing independent professional services for the public benefit.

In some respects GHD has proven a unique and appropriate practice for the Australian conditions of distance and diversity of activities. This arises out of its ability and capacity to serve the smallest to the largest projects anywhere in Australia with a whole array of expertise either in coordinated multi-discipline or specialist mode.
GHD has looked at the past and into the future and has drawn pride from its sixty years of practice. Its position confirms the nation's continuing need for its services in the achievement and operation of projects that enhance our economy and quality of life.
Appendix 1
This is how they grew

It is important to look back, to revive and record the history of the firm’s development so that with the knowledge of the past it is possible to pass on and expand the services and visions into the future.

Ivan Miller, GHD Director

1928 — A. Gordon Gutteridge established a private consulting engineering practice in Melbourne.

1933 — John F. Keays joined as engineer.

1934 — Bernard J. Callinan joined as an engineer.

1935 — Gerald Haskins and Geoffrey I. Davey commenced partnership as consulting engineers in Sydney.

1937 — Joint venture of the two practices formed in Brisbane to undertake Maryborough (Queensland) Sewerage Scheme.
— J.F. Keays transferred to Brisbane and H.V. (Jim) Trench joined as a surveyor.
— A. Gordon Gutteridge established Hobart office.

1939 — The two separate practices merged to become the partnership of Gutteridge, Haskins & Davey, Consulting Engineers.
— Commencement of World War II, staff enlistments included Messrs Keays, Callinan and Trench.

1942 — Death of A. Gordon Gutteridge and retirement of Gerald Haskins, leaving Geoffrey I. Davey as sole partner.

1945 — Cessation of World War II and the return of staff from War Service.

— Death of Gerald Haskins.

1948 — Establishment of offices in Cairns (Qld), and Launceston (Tas), and first job in Darwin.
— Associates became Partners, with G.I. Davey as the Governing Partner.

1952 — Total staff increased to 100 with offices at Sydney, Melbourne, Hobart, Launceston, Brisbane and Cairns.
1954 — Maryborough (Hervey Bay) office re-established.
   — Albert K. Streber, mechanical/electrical engineer of Sydney, became Partner.

1956 — Darwin office established.

1958 — Staff had increased to 200.

1959 — Phil Scott retired from Partnership.

1960 — Messrs. B.N. Fink (Melbourne), J.E. McCann (Sydney), A.G. Strom (Hobart) and N.H. Traves (Cairns) appointed as Associates.

1962 — Staff had increased to 300.

1964 — Retirement of G.I. Davey from the firm.

1965 — Messrs. B.N. Fink (Melbourne), J.E. McCann (Sydney), A.G. Strom (Hobart), N.H. Traves (Cairns) and J.C. Rivett (Brisbane) became Partners in the practice.

1966 — H.B. Elliott retired from the practice.
   — Staff numbers reached 400.
   — Australian Capital Territory office opened in Canberra.

1967 — Photogrammetric section established in Melbourne office with installation of first-order stereo-plotter.
   — Gold Coast (Qld) office opened.

   — Office opened at Ingham.

1969 — Opening of office in Horsham, Victoria.

1970 — Frankston (Vic.) office opened.
   — Staff increased to 500.

1971 — Messrs H.V. Trench and K.P. Inglis retired from the practice.
   — The practice was incorporated as Gutteridge Haskins & Davey Pty. Ltd., Consulting Engineers, with the appointment of B.J. Callinan as Chairman and Managing Director and J.F. Keays as Deputy Managing Director. The remaining Partners, B.N. Fink, J.E. McCann, J.C. Rivett, A.K. Streber, A.G. Strom and N.H. Traves, were appointed as Directors.
   — Establishment of Management Committee consisting of B.J. Callinan, B.N. Fink, J.F. Keays and J.E. McCann.
   — Admission of new Directors Messrs. I.C. Miller and H.G. Wolfram (Melbourne), R.A. Smith (Sydney).
   — Formation of three Regional Boards, with Chairmen being:
      J.E. McCann — NSW, ACT, SA.
      B.N. Fink — Vic., Tas., WA.
      J.F. Keays — Qld. NT.
   — Office established in Atherton, Queensland.
1972 — Townsville (Qld) office opened.

1973 — Admission of new Director R.J. Goakes (Cairns).
— Innisfail (Qld) office opened.

1974 — Retirement of J.F. Keays after 41 years service.
— Appointment of N.H. Traves as Chairman of Regional Board of Qld
and NT and Member of Management Committee.
— Formation of GHD-Parsons Brinkerhoff Pty Ltd, Transportation
Planners and Engineers, with Parsons Brinkerhoff Quade and
Douglas Inc. (USA)
— Staff numbers increased to 660.

— Offices established at Albury/Wodonga (NSW/Vic.); Bowen (Qld)
and Perth (WA).

1976 — Offices opened in Adelaide (SA) and Bundaberg, Mackay and the
Sunshine Coast in Queensland.

1977 — A.K. Streber retired after 37 years service.

1978 — Formation of Malaysian firm Angkasa-GHD Engineers Sdn. Bhd,
Consulting Engineers and Planners, with Angkasa Jurutera
Perunding Sdn Bhd.
— Traralgon (Vic) office opened.
— Sir Bernard Callinan retired after 44 years service.
— Appointment of J.C. Rivett as Chairman of Directors and B.N. Fink
as Managing Director and the admission of new Directors H.
Adcock (Cairns), A.G. Longstaff (Melbourne), P.H. Manger and T.M.
Smyth (Sydney), R.E. Macintosh (Brisbane), D.E. Skillington
(Hobart).
— Staff numbers reduced to 500.
— Management Committee comprised B.N. Fink, J.E. McCann, J.C.
Rivett and N.H. Traves.

1979 — Amalgamation into the GHD Group of D.J. Dwyer & Associates
Pty Ltd, consulting engineers and planners specialising in urban
planning and design and environmental engineering, with a staff
of approximately 100. D.J. Dwyer became director of GHD.
— Perth offices of GHD and DJD merged to become GHD-Dwyer
(WA) Pty Ltd.
— Total staff numbers 550 (25 offices in Australia and one in Kuala
Lumpur, Malaysia).

— Tom Pinzone moved to Newcastle to establish GHD office.

1981 — Merger with Planner West Pty. Ltd., Consulting Engineers, which
became the Mechanical and Electrical Systems Division of the GHD
Group.
— J.H. Planner and E.M. West became Directors of GHD. J. Planner also appointed to the Group’s Management Committee.
— R.V. Rose and J.T. Phillips became directors of GHD.
— R.J. Goakes retired after 21 years service.
— GHD-Vogan Pty Ltd, an urban property management company, established in association with Mr Allen Vogan.
— T.R. Saunders appointed Company Secretary following the retirement of F.J. Stapleton after 14 years service, ten of these as Company Secretary.
— Office established in Gladstone, Queensland.
— Formation of Australian Port Consultants (a joint venture with Alex Macknight and Associates).
— Continuing joint venture of GHD-Black & Veatch formally established.
— GHD-Wood Geotechnical Pty Ltd established following the acquisition of Wood Geotechnical Consultants Pty Ltd from Dr Clive Wood, who joined GHD.
— Staff numbers rose to 740 (including Planner West staff).
— GHD-Transmark joint venture established.

1982 — Staff numbers peaked at 820 (during resources boom).

1983 — Offices opened at Katherine (NT), Port Hedland (WA) and Rockhampton (Qld.)
— Admission of B.K. Mahony as Director.
— H.G. Wolfram retired.
— R.A. Smith appointed to the Management Committee and assumed the responsibilities of Manager, NSW Region, replacing John McCann who continued as Chairman, NSW Regional Board.
— Staff numbers stood at 643.

1984 — Offices opened at Alice Springs (NT) and Wollongong (NSW).
— J.E. McCann retired on 1 July, after 37 years service.
— Sydney office, including GHD-Planner West, consolidated into new premises at 39 Regent Street, Railway Square, Sydney.

1985 — Office opened at Airlie Beach, Queensland.
— GHD-Wright joint venture established.
— Death of John Keays and John McCann.
— GHD-Black & Veatch Pty Ltd established to replace former joint venture.

1986 — J.C. Rivett retired as Chairman and together with N.H. Traves retired from the Management Committee.
— B.N. Fink appointed Chairman; R.A. Smith appointed Deputy Chairman; H. Adcock appointed Managing Director; D.J. Dwyer appointed Director Corporate Business Development; J.H. Planner appointed Director responsible for mechanical/electrical and plant engineering; J.T. Phillips appointed Chairman of Western Australia
Region; P.H. Manger appointed Chairman of Victoria/Tasmania Region; R.V. Rose appointed Manager of Queensland and Northern Territory Region. All of the above were appointed to the GHD Management Committee.

- K.M. Conway appointed a Director.
- Death of Albert Streber.

1987  
- J.A. Crockett, P.G. Rudd and T.J. Pinzone appointed Principals.
- Rowe & Ennis, Sydney civil engineering practice, acquired.
- Parramatta (NSW) office opened.

1988  
- Coffs Harbour (NSW) office opened with the merger with Lockett & Montgomery, surveyors and planners.
APPENDIX 2
Awards for Merit

The professional man or woman in the field of engineering, in all its disciplines, is generally a 'doer' rather than a 'talker'. The low profile and what may have been said to have been a conservative outlook, in respect of seeking public acclaim, was carried into the outlook of their professional societies.

In the late 1960s the societies came to the conclusion that their members deserved a greater public recognition, perhaps, for the importance of their work to the community. The societies resolved to institute annual awards as a recognition of outstanding achievements within their professional fields.

GHD, always a supporter of the professional societies, won its first award in 1968 and has consistently been recognised from that time for outstanding achievement.

1968 — Royal Australian Institute of Architects (Tasmanian Chapter) Environmental Award — Gutteridge Haskins & Davey Pty Ltd Scottsdale Municipal Council — Sewage Treatment Plant.


1971 — ACEA Engineering Excellence Award — Gutteridge Haskins & Davey Pty Ltd. River Murray Commission — Salinity Investigation

1972 — ACEA Merit Award — Gutteridge Haskins & Davey Pty Ltd West Moorabool Water Board — Bungal Dam, Victoria.

1974 — The Institute of Materials Handling. H. A. Ritchie Award — GHD-Planner West Pty. Ltd. Sydney Woolbrokers Ltd — Unique wool bale handling system at Yennora, N.S.W.

1976 — ACEA Engineering Award — Gutteridge Haskins & Davey Pty Ltd Department of Transport/AWA Ltd — Antenna Systems for Interscan, Tullamarine.

1977 — ACEA Outstanding Merit Award — Planner West & Partners Pty Ltd (in association with Docker & Smith Pty Ltd). Port Waratah Coal Services Ltd — Pollution Control System for Port Waratah Coal Handling and Ship Loading Facility.

1979 — The Institution of Engineers Australia Engineering Excellence Award — Planner West & Partners Pty Ltd. Port Waratah Coal Services Ltd — Coal Handling and Ship Loading Facilities.
1982 — ACEA Engineering Award (Civil Engineering) — Gutteridge Haskins & Davey Pty Ltd. Department of Transport & Works, NT — Bagot Road Flyover, Darwin.

1983 — ACEA Engineering Award (Highly Commended) — Gutteridge Haskins & Davey Pty Ltd. Northern Territory Electricity Commission — Yulara Power Station.

— The Institution of Engineers Australia — GHD-Dwyer (WA) Pty Ltd. Worsley Alumina Pty Ltd/Raymond Engineers Australia Pty Ltd — Worsley Alumina Project, Water Management.

— The Institution of Engineers Australia, Northern Territory Division, Engineering Excellence Award — Gutteridge Haskins & Davey Pty Ltd. Department of Transport & Works, NT — Bagot Road Flyover, Darwin.

1984 — ACEA Engineering Merit Award — GHD-Dwyer (WA) Pty Ltd. Worsley Alumina Pty Ltd/Raymond Engineers Australia Pty Ltd — Worsley Alumina Project, Water Management.

1985 — ACEA Highly Commended Award — Gutteridge Haskins & Davey Pty Ltd. Water Resources Commission — Study of Waterlogging and Land Salinisation in Irrigated Areas of NSW.

— ACEA Award of Merit — Gutteridge Haskins & Davey Pty Ltd. Penrith City Council — Nutrient Removing Wastewater Treatment Plant, Penrith, NSW.

— ACEA Award of Merit — Gutteridge Haskins & Davey Pty Ltd. Melbourne Cricket Club — Floodlighting of Cricket Ground.

— Concrete Institute of Australia Award for Excellence — Gutteridge Haskins & Davey Pty Ltd. Kidston Gold Mines Ltd — Copperfield River Gorge Dam, Kidston, North Queensland.


— The Illuminating Engineering Society of Australia Meritorious Lighting Award Commendation — GHD-Planner West Pty Ltd. Bulk Grains Queensland — Fisherman Islands Grain Terminal.

— The Institution of Engineers, Australia, Victoria Division — High commendation — Gutteridge Haskins & Davey Pty Ltd. Rural Water Commission of Victoria — Study of Waterlogging and Land Salinisation, Barr Creek.

— The Institute of Materials Handling. H. A. Ritchie Memorial Trophy, GHD-Planner West Pty Ltd. Coal & Allied Pty Ltd and Port Waratah Coal Services Pty Ltd — Coal Transshipment Terminal, Port Waratah, N.S.W.
— The Institute of Materials Handling Merit Award — GHD-Planner West Pty Ltd. Bulk Grains Queensland — Fisherman Islands Grain Terminal.


— Institution of Engineers, Australia, Newcastle Division. High Commendation. Gutteridge Haskins & Davey Pty Ltd. — Department of Main Roads, N.S.W. — Environmental impact statement for the highway section between Wakefield and Minmi, N.S.W.

— ACEA. Engineering Merit Award. GHD-Dwyer Pty Ltd — Main Roads Department, W.A. — National Highway, Munjina Gorge, W.A.

— ACEA. Award of Merit. GHD-Planner West Pty Ltd — Port Waratah Coal Services Limited and Coal and Allied Operations Pty Ltd — Coal Transportation System, Catherine Hill Bay to Port of Newcastle, N.S.W.

— Institution of Engineers, Australia. Engineering Excellence Award (Resource Development category). GHD-Planner West Pty Ltd — Port Waratah Coal Services Limited and Coal and Allied Operations Pty Ltd — Coal transportation/transshipment system from Catherine Hill Bay to Port Waratah, N.S.W.

— ACEA. Award of Merit. GHD-Planner West Pty Ltd — Bulk Grains Queensland — Fisherman Islands Grain Terminal, Brisbane, Qld.

— ACEA. Highly Commended. GHD-Planner West Pty Ltd — Maritime Services Board of NSW and the Joint Coal Board — Bulk Export Transport Computer Model.

— The Institute of Materials Handling. Mike Munns Trophy, Merit Award. GHD-Planner West Pty Ltd — Bulk export computer simulation program, used by various clients over ten years.

— The Institution of Engineers Australia, Qld. Division. Engineering Excellence Award. GHD-Planner West Pty Ltd — Bulk Grains Queensland — Fisherman Islands Grain Terminal, Brisbane, Qld.

— Institution of Engineers Australia. Excellence Award (Public Works category). GHD-Transmark Australia — State Rail Authority of N.S.W. — Illawarra Railway Electrification project, N.S.W.
APPENDIX 3
SOME SIGNIFICANT CONTRIBUTIONS TO PROFESSIONAL SOCIETIES

From the time of Geoff Davey, GHD has been active in supporting the various Institutes serving the engineering disciplines.

The following members of GHD have contributed their time and skills to the advancement of the profession in the highest offices of the major associations at the National and State levels. In addition there have been dozens more who have been active members of National committees, branches, panels and local groups, and of the more specialised technical bodies.

The Institution of Engineers Australia

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<th>Division Chairman</th>
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<td>J.F. Keays</td>
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<td>A.G. Longstaff</td>
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Australian Water & Wastewater Association

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<td><strong>A.C.T.</strong></td>
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<td>P. H. Manger</td>
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APPENDIX 4
CORPORATE PHILOSOPHY

To be recognised as Australia's leading professional group practising in engineering, project management and allied disciplines.

To serve our clients by being responsive to their needs and by achieving a high standard of performance through innovation, technical skill, sound management and integrity.

To provide high level expertise in a wide range of engineering, planning, surveying, management and other professional areas.

To operate efficiently so as to provide for the improvement, growth and long term stability of the practice and to achieve fair returns for investment and effort.

To be a good employer and to provide a work environment which caters for job satisfaction and the development and well-being of the staff.

To practise on a wide geographic basis nationally and in selected areas outside Australia.
INDEX

Abattoir 4
Abbot Point 78, 229
Aboriginals — Wenlock River 99, 106, Darwin 111, Housing 116, 139,
Department 150
Adastra Airways 154
Adcock, Henry — Manager Brisbane 77, Cairns 90, 106, Mission River,
Weipa 100, Greenvale Railway 104, Copperfield River 172, Cairns
Airport 191, Overseas Work 233, Sarawak 239, Managing
Director 252
Ahern, Richard — Railways 69
Ainslie, Mt 138
Airfield Construction — Keays, Trench 28
Airports — 189, Honeymoon Mine 189, Williamtown Base 190,
Cairns 191
Alabaster, Dr John 177
Albury — Wodonga 176, 203
Alden, John — Thailand 245
Alice Springs 118
American Gas Association 51
ANCOLD 170
Anders, K. 234
Anderson's Creek 31
Anderson, Rex — 28, Manager Brisbane 73
Andong Dam 234
Andrews, Bill 131
Andrews, Dick 213
Angkasa Jurutera 222, 233, Ipoh 244
Angkasa-GHD 222, 243
Angwin, Col — Bougainville 237
Annan River 149
Aquaculture Research 151
Argyle Diamond 141
Arnold, Ralph 94
Artemisia, SS. 145
Asian Development Bank 234
Associates 247
Astor Terrace, Brisbane 76
Atherton Tablelands 146, Prawning Research 152
Atomic Energy 65, 219
Auckland 145
Austin, Bob — Thailand 245
Australian Aerial Mapping 214
Australian Groundwater Consultants 206
Australian Maritime College 147
Australian Port Consultants 227, 229, Trincomalee 245
Australian Prawn Farms 152
Australian Trade Practices XII
Australian Welding Institute 51
Avery, David 216
Avon Dam 9
Ayers Rock 127
Bagot River Flyover 126, 187
Baily, Phil — Wright Engineers 232
Baird, John — Alice Springs 129
Baker, Chris — Granard Rd Interchange 183
Baker, Tom — Torres Strait 98
Baldwin, Ivan 47
Balmain Tigers 201
Barcaldine 82
Barney Point 229
Barr, Don — 134, 137, Canberra 213
Barron River 146
Barton, Sir Charles 204
Bass XIII
Bassett and Partners 53
Beaconsfield 31, 32, 34
Beaconsfield Council — Tasmania 36
Beale, Sir Howard XII, 26
Beauty Point — 31, 34, Flume Tank 147
Bechtel 236
Beef Roads 112
Begg, Barrack and Douglass 54
Behana Gorge 158
Belconnen 136
Bell Jet Ranger 159
Bell, Keith — Brisbane 76
Bell, Sydney R. 26, 37, Death 55
Benedict, Mrs Alma — War Years 26, Melbourne 46, 55
Bennett, Jimmy — Barcaldine 84
Berlei House — Office 59
Bettany, Bruce — Wenlock River 98, Daintree 103, Cairns Airport 191
Bin Hindon, Tuan Haji Yusof Muhammad 222
Birds Rock Colliery 66
Bjelke-Petersen, Joh 105
Black & Veatch 130, 223, Trincomalee 245
Blackwater-Gladstone — Electrification 230
Blue Mountains 161
Boekhaven, Fred 111
Bougainville 56
Bougainville Copper 236
Bowling 198
Brand, Max 197, 213
Brett, David 167, Dams 172
Brewer, Cliff — Foundation 20, War Years 26, West Wyalong 154,
           Temora 155
Bridges — Milford Haven 48, Portland 47, West Gate 48, Barry Wilde,
           St Marys, Etheridge River 185, Burdekin River, Greenvale Railway,
           Mission River Weipa 186
Brighton Council — Tasmania 36
Brimson, Rev Fr D. Poem VIII
Brisbane Water Supply 21
Brischetto, Sid — Yulara 128, Cairns Airport 192
British Rail 230
Broadbent, Ross — 221, Channel Island 225
Brooke, Sir James 238
Bruce, Grahame — Torres Strait, 98, Roads 100, Torres Venture 150,
           Cairns Airport 192, Sarawak 239
Bryn Estyn 31
Bucca Weir 172
Buckley, John — Railways 80
Builders Labourers’ Federation 199
Bulk Grains Queensland 159
Bunbury 144
Bundaberg — Wastewater 80, Irrigation 172
Bundamba 176
Bungal Dam 56, 163, 170
Burdekin River Bridge 186
Burke and Wills XIII
Burrum River 72
Burrum Shire 27
Burton, John — Bagot Road 127
Bush Pilots 98
Butler, Town Clerk 110
Bynoe Harbour 152
Byrne, Roger — Water Supply 52
Cairns — Sewerage 89, Brewery 90, Airport 191
Cairns, Gordon — 213, Company Secretary 214
Callaghan, Paul — Surf Ski 154
Callinan, Bernard — T-Model Ford 5, 181, Branch Manager 14, 27,
           Catholic Schools 17, Foundation 19, Retirement 26, Tasmania 33,
           Partner 34, Surveying Takeover 36, War Years 41, End of War,
           Urban Planning 46, West Gate 49, Melbourne 55, Murray Valley 56,
           Knighthood 57, Canberra 133, Bougainville 235, Korea 235,
           Pahang 240, Associate 247, Chairman 248.
Callum, Jim — Torres Strait 98, Gove 116

271
Caltabiano, Sam — Mackay 106
Cameron, Don — Hobart 33, Water 180
Cameron, Geoff — Pahang 241
Campbell, Tom 76
Carne, Chris — Clare-Dalbég 105
Carroll, Archbishop 18
Cascade Dam 31, 162
Castlereagh Street Sydney — Office 60
Cattle Saleyards 4
Chambers, Harvey 213
Chandler Park 197
Channel Island Power Station 130, Black & Veatch 223
Chapman, Tony — Railways 69
Charles, Eric 15
Charters Towers 149
Chelsea Sewerage 45
Chiknaikin, Vladimir — Channel Island 225
Chins Building 109
Christensen, Gary — Oaklands 227
Christie, Syd 109
Ciachaz, John 133
Cimadori, Vic — Port Waratah 207
Citer, Joan 220
Citra House — Roger Smith 64
Clare-Dalbég Tramway 104
Clarence Council 35
Clarence Street — Office 60
Clarke, Ed 221
Clarke, Joan — Editing VIII
Clarke, Sandford 235
Clarke, Xavier — Channel Island 225
Cleland Robinson Pty Ltd 128
Coal Loading — Port Waratah 207
Cobb & Co. 92, 100
Coffey, Ian — Korea 235
Coffs Harbour Water Supply 20, 148, Television 219
Collins, Col 38
Collins, Francie — Barcaldine 85
Collins, Stan 93
Collins, W.A. 90
Colonel Lehr 28
Continental Insurance 145
Conway, Ken — Special Projects 60, Vales Point 63 Railways 69.
Thailand 245
Conzinc-Rio Tinto 236
Cooktown 149
Coombing Creek Dam 163
Cooper, Mayor 110
Copperfield River Gorge Dam 80, 171
Corella River Dam 164
Corrigan, Miss 46
Coulter, Hon Barry — Channel Island 226
Cowen, Sir Zelman 198
Cradle Mountain Road 182
Craigbourne Dam 172
Cranbourne Sewerage 45
Crane, Bob — Malaysia 243
Cranney, Jim 213
Crawford, Tom 146
Crockart, Rod — Sarawak 239
Crockett, Jonathan — Hamilton 44, 56, Water 176, Malacca 243
Crocodile Breeding 206
Croomer, Roger 177
Curries River Dam 32, 167
Cycling 196
Cyclone Tracy 118
Dall, Jeff 46
Dalrymple Bay 229
Dams — Avon 9, Derby 13, 164, Mt Isa 13, 32, 165, Mary Kathleen 13, 32, Mt Paris 31, 163, Cascade 32, 162, Curries River 32, 167, Risdon Brook 38, 165, Warners Creek 38, Bungal 56, 163, 170, Burren 72, Copperfield Gorge 80, 171, Coombing Creek 163, Rocky Creek 163, Corella River, East Leichhardt River, Hume, Leichhardt River, Porter’s Creek, Sooley Creek 164, Wenlock River 165, Dangera Creek 166, Spencer, Ophthalmia 167, Tennant Creek 168, Killara Golf Club 169, Craigbourne, Willow Creek 172, Andong 234
Danfield, Danny — Barcaldine 84
Danger Creek Dam 166
Darwin Casino 129
Darwin Town Council 109
Davey — Geoff — Compassion XI, Biographical, Partnership 10, 13, 19, Catholic Schools, Catholic Weekly, Mater Misericordiae, Ordination, Papal Knight 17, Gillean 19, War Years 25, Loss on War Contracts 30, The McPhedrans 35, Recruiting Staff 46, Coombing Creek 61, Brisbane Partnership 72, Weipa 98, Northern Territory 109, 115, Canberra 132, Aerial Surveys, Asbestos Pipes 154, Dams 162, 165, Sooley Creek 164, Dangera Creek Dam 166, ANCOLD 170, Water Schemes 176
Davey, Nancy 17
Davey, Richard 18
Davis, Lincoln — Roads 81, Granard Rd Interchange 183
Defeyter, Maurice — Channel Island 226
de Lacy, Pamela — GHD News VII
Delamothe, Dr Peter 75
Deloraine Water Supply 2
Denham, Lady 131
Dennis Brooke Constructions 53
Dept Primary Industries, Queensland 151
Derby 31, 162, 164
Derwent River 31
Devonport 31
Dickinson, Joan — Assistance VII, 60
Dobner, Joe 38
Docker and Smith 221
Dodt, Russell — Dams 172
Donohue, Cusick and Edwards 74
Dudgeon, Don 35
Dwyer, D.J. & Associates Canberra 132, Perth 140, 212
Dwyer, Don — Assistance VII, Corporate Business Development 60, 253, Merger 66, 215, Cyclone Tracy 123, Perth 140, Director 142, Environment 203, Foundation 212, Canberra, Darwin 213, Jakarta, Perth, Norfolk Island 214
Dwyer, Jack 135, 212
Dwyer, Margaret 212
Eaborne, Ron — Gove 116
East Hills Railway 188
East Leichhardt River 164
Easther, Ann — Cyclone Tracy 124
Easther, Peter — Cyclone Tracy 124
Edwards, Steve — Channel Island 226
Einasleigh River Bridge 153
Elaroo 159
Elliot, Bill — War Years 26, Associate 247
Emde, Prof. von der 176
Emerald — Electrification 229
Ennis, Doug 231
Esperance Wharf 228
Espie, Frank 16
Ethics XII
Evans, Harry 98
Expo '88 81
Falk, Jonathan — South Bulli 68
Fickle, Lee 225
Fink, Ben — Mornington 44, Employment, Sewerage Schemes 46, West Gate 49, Office Manager 55, Partner 56, 247, Managing Director 57, 59, 250, Advancement Medal 58, Yulara 128, Director 142, Dams 170, Water Control 176, Victorian Board 251, Chairman 252
Fisher Lewis 231
Fisher Shepherd 231
Fisher, Jack 213
Fisher, John — Collins Plaza 65, Bagot Road 126, Landing
   Towers 193
Fisher, Paul 231
Fisherman Islands 159, 227
Fleming, Leon 237
Flinders Sewerage 45
Forbes, Brian — Burrum Dam 72, Dams 80, 172
Ford, Bob 133
Four Mile Beach 201
Fowler, Peter — Channel Island 225
Francki, Matt — Cairns Mall 184
Franklin River 203
Frankston Sewerage 45
Frew, John 10, Brisbane 14, Launceston 33, Manager Brisbane 73
Fricke, Tom — Melbourne 57, Perth 140, Computers 158, Bungalow
   Dam 163, Worsley 167, Pahang 241, Malacca 243
Friend, Henry — Cairns 90, Cairns Sewerage 96, Bougainville 237,
   Malacca 243
Furniss, Keith — Railways 69
Gaden Trout Hatchery 138
Garden, Jock 9
Geddes, Andrew — Railways 69
George, Don 65
Geraldton 144
Gersekowski, John — Bagot Road 127, Channel Island 130, 225
Ghan Railway 159
GHD Transportation Consultants 223
GHD-Wood Geotechnical 227
Gilchrist, E.F. 28
Gillean, Gordon 19, 31, War Years 26, Hobart 35
Gilroy, Cardinal 18
Gladstone-Brisbane — Electrification 230
Glenelg Sewerage 3, 175
Goakes, Bob — With Councillors 75, Manager Brisbane 77, Cairns
   90, 106, Weipa South 100, Booroloola 112, Turtle Farming 207,
   New Guinea 237, Sarawak 238
Goffin, George 22, 73
Goldsworthy 144
Golf Courses 197
Goodsell, John 9
Grafton 27
Grain Elevators Dunnolly, Horsham 51, 221
Granard Road Interchange 183
Gray, Bunny 179
Greenvale Railway 104
Grey, J.J.W. 109
Griffin, Ron — Korea 235
Griffin, Walter B. 131
Griffith, Gwyn 232
Guesdon, Charles — Expo '88 81, Clare-Dalbeg 105, Townsville 106
Gulf Developmental Road 102
Gutteridge, David 7
Gutteridge, Elizabeth 7
Gutteridge, Eric 1
Gutteridge, A. Gordon — Compassion XI, Biographical 1, Rolls Royce 5, 181, Mayor Kew, Marriage 5, Foundation 19, War Years 26, Death 33, Foundations 41, Opens Queensland 71, Brisbane Partnership 72, Policy 92, Glenelg 175
Gutteridge, Hal 1
Gutteridge, Mary 1, 21
Gutteridge, Noel, 1, 21
Gutteridge, Patricia 7
Haan, Douwe de 37
Hallows, Peter — Murray Valley 56, Murray River 177, Salinity 179, Oaklands 227, Korea 234, Pahang 241
Hallows, Sandra 235
Hamer, Hon R.J. 50
Hamersley 143
Hamilton Earth Movers 43
Hamilton Sewerage 43
Hamilton, Barry 214, 216
Hamilton, Peter — GHD News VII, Corporate Business Development 60
Hammond, Bruce — 110, Katherine 130
Hampson, Kerry — Cyclone Tracy 123
Hansford, Mick 34
Harding, Ken — Korea 234, Panguna 237, Pahang 241, Thailand 245
Hardy, Dawn — Assistance VII, 213
Harrap, Rob — Abbot Point 78, New Guinea 237
Hart, Dr Barry 177
Hart, Gerry — Channel Island 226
Hartley, Ken — Sewerage 80, Book, Treatment Plants 180
Haskins, Betty 8
Haskins, Dorothy 10
Haskins, Geoffrey 8
Haskins, Gerald — Biographical 7, Partnership 19, Brisbane Partnership 72, Coffs Harbour 148, Asbestos Pipes 154, Temora 155, 163, Water Schemes 176
Haskins, Janet 8
Haskins, John 8, 10, 163
Haskins, Phillip 8
Hassall and Partners 235
Hatsell, Crofton — Devonport 36, 133
Hawkes, Ralph — Barcaldine 83, Etheridge 93, Torres Strait 98, Cyclone
    Tracey 123, Torres Venture 150, Turtle Farming 207
Hazelton, Nancy 12
Hazledon, Bernice 220
Hazlewood, Trevor — Abbot Point 78, Grain Storage 159, 221
Heinz, H.J. 55
Helipads 97
Herrmann, Kathy — Channel Island 225
Heyting, Ed — Channel Island 225
Higgins, Ray — Railways 69
Hitchcock, Gordon 105
Holdcroft, Cecil 92
Holdsworth, Aub — War Years 26
Holland, Sir John IX
Honeymoon Mine Airport 189
Horlyck, Lance 197
Horne, Colin — Bagot Road 127
Hornibrooks 172
Hoskin, Russell — 127, Dams 172
Hoskins Memorial Church 67
Hospitals — New Norfolk, Royal Hobart 39, Queensland 77
Hume Dam 164
Humpty Doo 113
Hunter Street, Sydney — Office 59
Hunter, Pauline 235
Illawarra Railway Line 188, Electrification 230
Ingles, Professor — Unisearch 116
Inglis, Ken — 13, Coffs Harbour 20, 148, Steam Tug 20, American
    Army 28, Environment 203, Associate 247, Chairman 248
Institution of Gas Engineers 51
Ipoh 222, 244
Ipswich — Sewerage System 80
Ipswich Road 183
Irrigation — Huon Region, Longford, Cressy 38, Bundaberg 173
Irwin, Alan 221
Isabella Plains 133
Jacks, Wendy — Channel Island 225
Jackson, Andrew — West Gate 50
Jackson, Robert 144
James, Ken 32, 167
Jeffrey and Katauskas Pty Ltd 127
Jerrambomberra 137
Jindabyne 138
Jones, Clem 73
Kalin, Tom — Channel Island 225
Kamilaroi Retirement Centre — Solar Power 205
Kamunting 222
Karratha 144
Keable, Bruce 237
Keast, A.J. 109
Keays, John — Assistance VII, First Staff 3, Wangaratta 4, Deniliquin 5, Branch Manager 14, Foundation 19, Maryborough 21, 27, 31, Manager Queensland 71, Joins RAAF 73, Gregory Terrace 74, Reservoirs 75, Retirement 76, Barcaldine 83, Cairns 89, 94, Darwin 112, Associate 247, Queensland Board 251
Keirnan, Warwick — South Bulli 68, Salinity 179, Canberra 213, 214, Perth 215
Kelly, Bryan — Darwin 111, Gove 115
Kemp, Andrew 137, Thailand 245
Kenworthy, John — Yulara 128
Kerr, George — Brisbane 22, 72, Adelaide 27
Kerr, Ursula — Cairns 107, Cairns Mall 184
Kidston Gold 91, 142, 171
Killara Golf Club Dam 169
King Island 32
Kirby, Phil — Channel Island 225
Kiriwina Airfield 28
Kohleppel, Bob — Channel Island 225
Konyi, George 216
Korea 233
Kuala Kangsar 222
Kuala Lumpur 222
Labor Party 1
Lake Moondarra 164
Langton, Fred 122
Last, Ron — Abbot Point 78, 221
Latrobe Valley 37, 50, 133
Launceston — Flume Tank 147
Lawrence, John 81
Lees, Darryl — Channel Island 226
Leichhardt, Ludwig XIII
Leichhardt River Dam 164
Lemon, Dave 221
Lemons, Ed — Channel Island 225, Oaklands 227
Leprosarium 225
Leslie Salt 144
Leupen, Richard — South Bulli 68
Lew, Thomas — Manager Brisbane 73
Lewis, Tony — 133, Flume Tank 147, Cairns Mall 184
Libraries 60
Lloyd, Chris — Hamilton 44
Lloyd, Robert — West Gate 50, Melbourne 55, Cyclone Tracy 119, 122, 124, Bagot Road 126, Overseas Work 233
Long, Norm 137, Thailand 245
Longley, Colonel 2
Longstaff, Alan — Director 35, Sewerage 46, Stawell 55, Mornington 57, Darwin 110, Gove 115, Malacca 243
Loughnan, Professor — Unisearch 116
Lucy, Sister 18
Ludwig, Ken — Channel Island 226
Luna Park 146
Luscombe, Ivan — Cairns 92, 116, Cyclone Tracy 122
Mace, Warwick — Channel Island 225
Machin, Fred — Canberra 14, War Years 26, Environment 132, 203, Associate 247
Macintosh, Bob — Water 180, Environment 204, Malaysia 243
Mackie, Graham — Perth 140, 142, 214, Perth 215
Macknight, Alex — 228, Australian Port Consultants 229, Thailand 246
MacMaster, Don — Cyclone Tracy 123, Darwin 213, Perth 215
Maher, Tom 46
Mahony, Brian — Plant Engineering 60, South Bulli 68, 221
Main Line Electrification, Qld 189, 230
Malacca 222, 243
Malanda Milk 105
Malaysia 56, 222
Manger, Peter — Employment 46, Manager-elect 57, Mt Arthur 63, Canberra 132, Oaklands 227, Victoria/Tasmania Regional Board 252
Marble Bar 144
‘Margaret Mary’ 115
Marks, Roger — Behana Gorge 159
Marsh, Reg 109
Martin, Terry — Channel Island 225
Mary Kathleen — Dam 13, 32, Water Supply, Sewerage 16, 164
Maryborough — Day Labour 21, 27, Sewerage 72
Matthews, John — 116, Channel Island 130, Darwin 157
Maui Gas 145
Maxwell, Ray — Laleham Mine 78, 145
McAvoy, David — Darwin 110
McCann, John — Assistance VII, Employment 46, Coombing Creek 61, Darwin 109, Humpty Doo 113, Swimming Pools 200, Partner 247, NSW Board 250, Death 250
McCredie, Bill — GHD News VII, Oaklands 227
McGrath, Brian 237
McGuffie, Keith — Clare-Dalbeg 105
McGuire, Frank — Sewerage 46
McInerney, John — Manager ACT 213
McKenzie, Harold — Cyclone Tracy 119, 123, 125, 214
McKenzie, Mrs — Cyclone Tracy 119
McKnight, Tim 111
McMahon, Sir William 240
McPhedran, Alex — Hobart 33, Death 36, Valve 158
McPhedran, Daphne 35
Meaney, Tom 113
Megalong Valley 161
Meinhardt, Phillip 46, 56, 156
Melbourne Cricket Ground 198
Meldrum, Rob — Channel Island 225
Menzies, Sir Robert 131
Mews, Colin — Cradle Mountain 182
Meyer, Oscar 50
Michael, Don — Cairns 91, Weipa Airstrip 100, Roads 102
Milford Haven Bridge 48
Miller, Ivan — Melbourne 55, Photogrammetry 46, 56, Stadia
Protractor 156, Award of Merit 199, Fisher Lewis 231,
Bougainville 235, Pahang 241, Director 248
Mining — Mt Arthur 63
Minnett, Harry 192
Molloy, Larry — Clare-Dalbeg 105
Monks, Bernard 38
Monteith, Lindsay — Darwin 130, 157, Malaysia 245
Moore, A.B. 76
Moore, Ann — Melbourne 55
Mornington Sewerage 44
Mt Arthur North 63
Mt Buller 196
Mt Isa Dam 13, 32, 164
Mt Martha Sewerage 44
Mt Newman Mining 167
Mt Paris Dam 31, 163
Munjina Gorge 143
Munroe, Ken — Torres Strait 98
Murphy, Charles — War Years 26
Murray Valley 56
Murray, John — Assistance VII, Devonport 36, Wharf, Ulverstone,
Latrobe 37, Hamilton 44, Sewerage 46, Dams 163, Malacca 243
Nabalco 116
Naktong River 234
Nancarrow, Norman — West Gate 50
National Capital Development Commission 131, 137
Natural Gas — Sale, Geelong 51
Neutral Bay — Office 60
Nevins, Tom 235
Newman 143
Ney, Ken 216
Ngukurr — Sewerage 117
Nichols, Peter — Channel Island 225
Nile Perch 152
Nolan, Jim 14
North Esk 37
North West Shelf 229
North, Dulceea 12
North, John — 12, Brisbane 27, Manager Brisbane 73, Cyclone Tracy 124
Northern Riverina Water Supply 61
Nowra Water Supply 166
Nullabor Plain 105, 140
O'Connell Street, Sydney — Office 60
O'Flaherty, Phillip — Channel Island 225
O'Malley, King 131
Oaonui 145
Odour Removal 206
Ophthalmia Dam 167
Ovaltine 32
Overall, Sir John 131
Owen, Ron — Dams 172
Paka Power Station 222
Parsons Brinckerhoff 223
Partnerships 20
Peake, Owen — Channel Island 226
Pelican Island 110
Pender, John 76
Penhaligon, Ron — Burrell Dam 72, Employment 74, Darwin 109
Peninsula Developmental Road 102
Penrith City Council 62
Pepper, Dick 112
Pertel, John — 214, 216
Pfeiffer, Jim 135
Phang, A.L. 243
Phillips, John — Perth 141, 215, Worsley, Ophthalmia 167, Tennant Creek 169, Bungal Dam 170, Sarawak 239, Regional Board W.A. 252
Phillips, Keith — Fisher Lewis 231
Phillips, Roger — Launceston 36
Phipps, Dawson — Barcaldine 84
Pierce, Doug 216
Pierce, Miles — 199, 221, Oaklands 227
Pig Saleyards 4
Pine Gap 118
Pinzone, Tom — Newcastle 66
Plambeck, Joe 111
Planner West — Bendigo 51, Merger 66, Canberra 137, Yennora Wool 149, Grain Storage 159, 219
Planner, Dorothy 220
Planner, John — Mechanical, Electrical 60, 252, Foundation 219,
   Director 221
Plumb, Colin — Pahang 241
Point Ceylon Prawn Farm 152
Polin, Mike — Malaysia 233
Polley, Bob 134
Pollock, Ron 216
Port Douglas 201
Port Hedland 143
Port Huon 229
Port Waratah 221
Porter’s Creek Dam 164
Portland Bridge 47
Pout, Denis — Vales Point 63, 221
Powierza, Lech — Darwin 111, Cyclone Tracy 122
‘Princess of Tasmania’ 37
Proserpine 159
Pyne, Frank 103
Queanbeyan 137
Queensland Port Consultants 229
Queensland Stone Constructions Pty Ltd 159
Quoich Dam 166
Railways — Birds Rock 66, Greenvale 74, Mackay Harbour, Moura 77,
   Blackwater, Curragh 78, Greenvale 104, 186, East Hills 188, 230,
   Illawarra Electrification 188, Goonyella Line, Toowoomba 189,
   Mount Newman, Skitube 230
Rapid Creek 197
Read, Brian — Cyclone Tracy 124
Red Hill 137
Redcliffe Sewerage System 80
Reece, Hon. Eric 37
Rees, Tom — Darwin 130
Reid, John 186
Reid, Tony 137
Reinforced Earth 186
Reinhardt, Peter — Wollongong 219
Rejnders, Mrs — 21, Brisbane 71
Reynolds Metal Company 167
Richardson, Mayor 110
Ridge, Barry — Channel Island 225
Risdon Brook Dam 38, 165
Risdon, Brian 216
Ritchie, Bill 38
River Murray — Floodplan 203
Riverside Council — Tasmania 36
Rivett, Bob — Chairman 59, 76, 249, Employment 74, Manager Brisbane
76, Greenvale Railway 104, Australian Port Consultants 229,
Overseas Work 233, Partner 247, Strategy Plan 252
Roads — Gulf Developmental 102, Peninsula Developmental, Burke
Developmental 102, 181, Granard Rd Interchange, Ipswich 183,
Bagot Road 187
Roberts, Ray 100
Robson, Bruce — Melbourne 55
Robson, Mal — Dams 166
Roche Bros Pty Ltd 171
Rochfort, Mick — Brisbane 73
Rocky Creek Dam 163
Rodd, Mike — Pipeline 51
Roderick, Prof. John 63
Rogers, Meredith — South Bulli 68
Rose, Ray — Director 71, Burrum Dam 72, Greenvale Railway 74, 104,
With Councillors 75, Manager Brisbane 77, Laleham Mine 78,
Railways 80, Weipa 100, Cooktown 103, Queensland Manager 252
Rowe and Ennis 231
Rowe, Arthur 38
Rowland, John — Darwin 157, Channel Island 225
Rowlands, Neil — Principal 221, Channel Island 225
Rowntree Chocolates 48
Rudd, Peter — Roads 81, 134, Granard Rd Interchange 183
Ruskin, John XII
Rutledge, Len 106
Ryan, J.T.S. 212
Ryan, John — Pipeline 51, Brisbane 76, Sewerage 80, Cairns
Annan River, Charters Towers 149, Dams 165, Water 180
Saddington, Mike — Korea 235
Safe, Kevin 43
Salinity — 179, Murray River 205
Sallermann, Seig 216
Salthouse, Peter — Cyclone Tracy 123
Sandford, Ian 56
Sangster, Judy — Typing VII
Santubong — Malaysia 228
Saunders, Bert — Alice Springs 130, 213
Saunders, Bill — Jacking Device 216, 217
Saunders, Trevor — Company Secretary 59, 253
Sawyer, Dr Clair 177
Schaffner, Dennis 38
Scott, Jim — Malaysia 222, Pahang 241
Scott, Philip — War Years 26, Melbourne 46, Brisbane 74, Associate 247
Scottsdale 27
Sea Fish Authority 147
Settles, Bill — Channel Island 226
Sewerage Schemes — Glenelg 3, 176, Warrnambool, Devonport 3, Mary Kathleen 16, West Wyalong 19, 154, Scone, Yass 19, Junee, Grenfell 20, Toowoomba 21, Maryborough 22, 27, 72, Grafton 27, Devonport, Wangaratta 31, Hamilton 43, Mornington, Mt Martha 44, Chelsea, Frankston, Flinders, Cranbourne 45, Stawell 55, Bowen, Aramac, Wynnnum-Manly, Sandgate 73, Ipswich, Bundaberg 80, 180, Redcliffe 73, 80, 180, Barcaldine 73, 83, Cairns 89, Mareeba, Ravenshoe, Gordonvale, Babinda, Ingham, Innisfail 90, Nightcliff 110, Ngukurr 117, Darwin, Alice Springs 128, Katherine, Oenpelli 129, Perth 140, Gold Coast 73, 180, Woodman Point 215, Malacca 222, Arawa 237
Shay Gap 144
Sheenan, John — Barry Wilde Bridge 185
Sheep Saleyards 4
Shephard, Alan 111
Sherson, Ross — Wollongong 219
Shival, Prof. Hillel 176
Shore, Rod — Surf Ski 154
Siers, Peter 221
Sinclair Knight and Partners 240
Skiing 195
Skillington, David — Hobart 34, Clarence 36, Manager 37, Flume Tank 147, Dams 163, 165, 172, Cradle Mountain 182
Skinner, Don — Employment 36, Melbourne 56, 221
Skitube Rack Railway 230
Smart, Ken — Hobart 35, Cairns 90, 94
Smirk, Hugh — Dams 168, 172
Smith, Barry 219
Smith, Hal — Channel Island 225
Smith, Kay 235
Smith, Mervyn — Melbourne 55
Smith, Roger — Regional Board 60, to UK 64, Gove 116, Porter's Creek Dam, Sooley Creek Dam 164, Dangera Creek Dam 166, Barry Wilde Bridge 185, Director 248, NSW Board 250, Deputy Chairman 252
Smith, Ross — Pipeline 51, Korea 234, Malacca 243
Smyth, Timothy — Malaysia 60, 233, Panguna 237, Sarawak 239
Snowy Mountains 234
Snowy Mountains Engineering Corporation — Pahang 240
Solar Power 204
Soulby, Jack 60
South Bulli Colliery 67
South Korea 56
Southern Riverina Water Supply 61
Sparks, Geoff — Employment 46, Coombing Creek 61, Brisbane 74,
   Dams 163
Spaulding, Mike — Bougainville 237
Spencer Dam 167
Spencer, Jack 212
Spooner Plan 3, 19
Spooner, Hon. E.S. 148
Spowers, Allan — Pahang 241
Sproats, Graham — Darwin 130, Channel Island 225
Standfield, Graham — Cairns Airport 192
Staniland, Dorothy 8
Stanley, Gary 133
Stapleton, Fred — Company Secretary 253
Stawell Sewerage 55
Steelcon Constructions Pty Ltd 127
Stern, Hans 59
Stone, Frank 213
Stone, Rodney 33, 37
Stratford 146
Streber, Albert — Appointment 28, Munitions Factory 59, Transmission
   Lines 62, Korea 234, Pahang 241
Strom, Alan — Assistance VII, Launceston 33, 37, Melbourne 37,
   Employment 46, Partner 56, 247, Perth 141, Dams 163, Spencer Dam,
   Worsley 167, Bungal Dam 170, Water Control 176, Murray River 177,
   Button Grass 179
Stuart, McDowell XIII
Subsidence 66
Sultan of Pahang 222
Surveys 61
Swanson, Tom — 140, Perth 215
Swimming 199
Swimming Pools — 61, Cairns, Mareeba, Atherton, Tully, Cardwell 90,
   Melbourne, Ryde, University of New South Wales 205, Ipoh 222
Sydney Farm Produce Markets 221
Sydney Monorail 60
Syme, Annabel 5
Tabart, Ken — Devonport 36
Taber, Rob — Dams 169, 199
Tamar River 32
Taranaki — Keays, Traves 28
Tasic, Bruno 111
Tate, W. 10
Temora 155
Tennant Creek Dam 168
Thomas, Lew 28
Thomas, Otto — Cyclone Tracy 123
Thompson, Alan — Cyclone Tracy 121, 125, Cradle Mountain 182
Thorn, Gordon 213
Torres Shire 96, 150
Torres Venture 150
Touch Football 197
Town Planning — Redcliffe, Southport, Surfers Paradise, Cairns 75
Tramway — Clare-Dalbeg 105
Transmark 230
Traves, Norm — Assistance VII, Dams 13, Davey’s Sympathy 14, War Service 28, Manager Queensland 71, Burrum Dam 72, Cairns 74, 89, Reservoirs 75, With Councillors 75, Weipa 98, Cyclone Tracy 119, Chickens 146, Annan River 149, Environment 204, Channel Island 225, New Guinea 237, Panguna 237, Partner 247, Queensland Board 253
Tree of Knowledge 82
Trench, Jim — Brisbane 22, 73, War Service 28, Surveying Takeover 36, Photogrammetry 56, Plane Table 156, Associate 247, Retirement 248
Trengganu Oil Terminal 222
Trincomalee 245
Truscott, Dr Glen — Dams 13, 80, Worsley 167, Channel Island 225, GHD-Wood Geotechnical 228
Tseng, Mike — Malaysia 233, 243, Ipoh 244
Tuggeranong 133
Turtle Farming 207
Tyler, Dr Peter 177
Ulverstone Council 37
Upper Burdekin 32
Urquhart, Chundah — Barcaldine 84
Vales Point 63
Van Dike, Peter 221
Van Es, Ron — Roads 60, 213, 231
Very Fast Train 230
Vesteys Beach 228
Vincent, Robert — Yulara 128
Vogan, Allen — GHD-Vogan 228
Vowell, Richard 22
Wabo Power Station 228
Wagstaff, John 221
Walkamin Fish Project 152
Walker, Dr Keith 177
Walker, Mac 6, War Years 26, 31
Wangaratta 31
Warner, Tom 14
Warners Creek Dam 38
Warrnambool Sewerage 3
Water Supply — Deloraine 2, Mary Kathleen 16, Coffs Harbour 20,
Brisbane 21, Southern Riverina 22, 61, Scottsdale 27, Beaconsfield,
Beauty Point, Hobart 31, West Tamar 37, Northern Riverina 61,
Burrum River, Howard, Torbanlea, Hervey Bay 72, Bowen 73.
Mareeba, Atherton 74, 89, Port Douglas 88, Ravenshoe, Herberton,
Innisfail, Ingham, Yungaburra, Millaa Millaa, Mt. Molloy, Kuranda,
Mt. Garnet, Kairi, Cooktown, Georgetown, Croydon, Mossman 89,
Nightcliff 110, Monarto, Gold Coast, Lake Burley Griffin 178,
Bougainville, Malaysia 179, Kuala Kangsar, Kamunting 222
Water Technology Cell 176
Weipa 98
Wenlock River 98
Wenlock River Dam 165
West Gate Bridge 48
West Tamar 37
West Wyalong Sewerage 154
West, Mrs Billie — Cyclone Tracy 122
West, Ted — Mechanical 60, Port Waratah 207, Foundation 219,
   Director 221
Whitaker, John VIII, 16
White, Colin — Sewerage 46
Whittaker, Phil 221
Whybird, Des — Millaa Millaa 105, Cairns Airport 192
Wickham Terrace 76
Wild, Paul 192
Wilding, David — Clare-Dalbeg 105
Wilke, Len — Assistance VII, 52
Williams, Prof. Bill — 176, Water Supply 177
Williamstown Airbase 190
Willow Creek Dam 172
Wilson, Norm 212
Winton, Roger — Aborigines 118, Cyclone Tracy 121
Woden 133
Woerle, Frank 111
Wolfram, Hans — West Gate 49, Employment 56, Malaysia 222,
   Director 248
Woo Hin Wai 222, 243
Wood, Dr Clive — Channel Island 225, 227
Worsley 140
Worsley Alumina 167
Wrest Point Hotel 197
Wright Engineers 231
Wyles, Neil — Electrical 60, 220
Yennora Wool 149
Young Street — Office 60
INDEX

Young, Ed — Pahang 241
Yulara 127