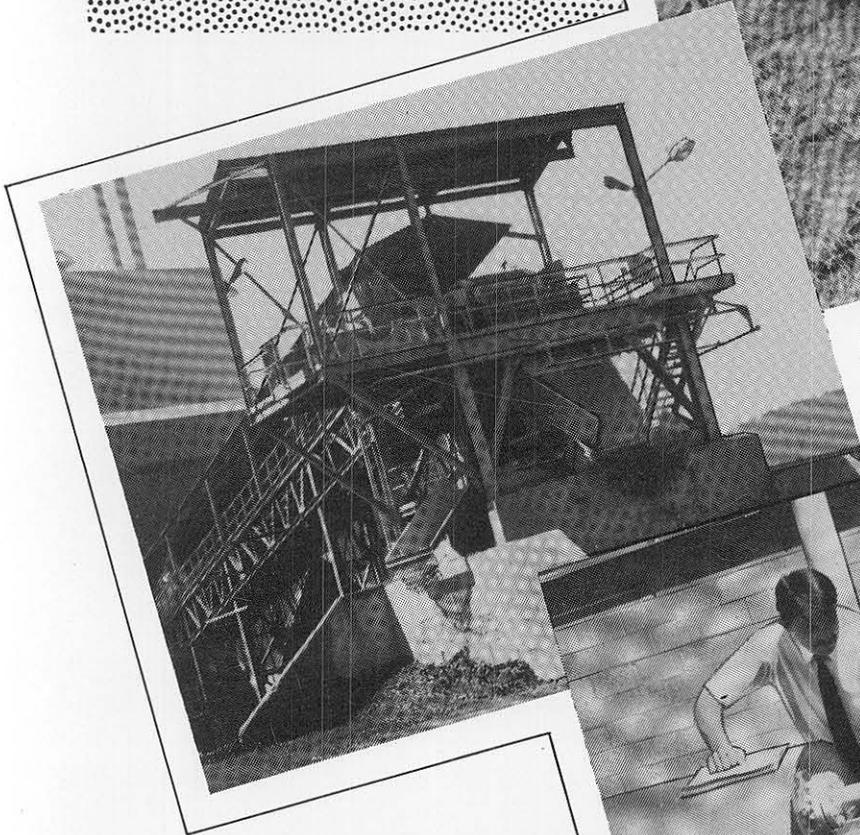
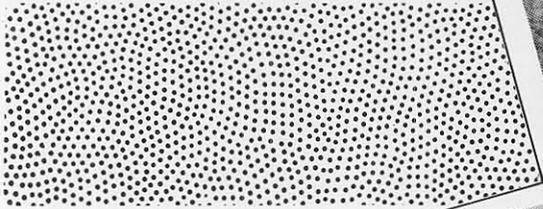
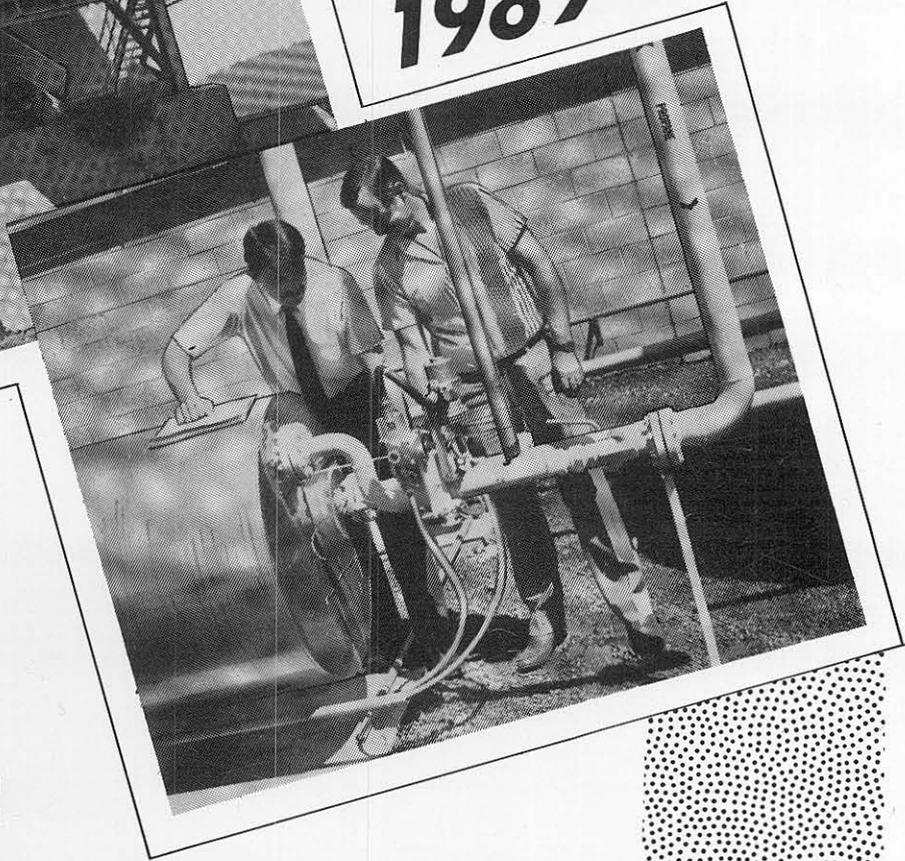


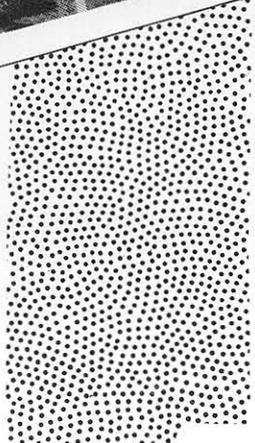
TASMANIA DEPARTMENT OF RESOURCES & ENERGY



1989-1990



REPORT OF THE DIVISION OF MINES & MINERAL RESOURCES





TASMANIA

Department of Resources & Energy

DIVISION OF MINES & MINERAL RESOURCES

Report of the Division of Mines & Mineral Resources

1989 – 1990

The Department of Resources and Energy

The Department of Resources and Energy was formed on 17 July 1989, and incorporated the former Department of Mines, and the Rivers and Water Supply Commission. Each has formed a division of the new department, and are now titled "The Division of Mines and Mineral Resources" and the "Water Resources Division" respectively. This report incorporates an edited summary of the report of the Department of Resources and Energy, and the report of the Division of Mines and Mineral Resources.

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THE DEPARTMENT OF RESOURCES & ENERGY

THE DEPARTMENT

The Department of Resources and Energy is the Agency through which the Tasmanian Government gives effect to policy in relation to mineral, water and energy resources.

The Agency was established on 17 July 1989 as part of the Government's initiative to create a more effective, efficient and responsive public service.

The Department's constituents comprise:-

- The Division of Mines and Mineral Resources
- Water Resources Division (incorporating Rivers and Water Supply Commission)
- Responsibility for energy policy advice to Government.

HEAD OF AGENCY'S REVIEW

The year ended 30 June 1990 was a difficult one for the recently created Department of Resources and Energy.

The late Mr Don Williams, in the dual role as Head of Agency and General Manager of the Hydro-Electric Commission (HEC), had started to bring together the various components of the Resources and Energy portfolio. His tragic death on 2 September 1989 brought those initiatives to an abrupt halt.

The appointment of a Secretary, Department of Resources and Energy, was effected on 23 April 1990, following the decision to separate the Head of Agency functions from those of General Manager, HEC. In the interim Mr Ron Harvey provided sound guidance and support for the embryonic Department. On behalf of the Department I would like to thank Mr Harvey for undertaking this demanding role.

Despite these early difficulties the year was a successful one, both in the delivery of services and in the commencement of development of the Agency.

It was pleasing to see a reduction in the frequency rate of lost-time accidents in mines and mineral processing works throughout the State. The reduction amounted to 33% and makes Tasmania the State with the least amount of lost time due to accidents.

A joint project with funding from Local Government has resulted in the production of a 1:25 000 engineering geology map of the Greater Hobart Area. This map will be of great use to Local Government, architects and design engineers in subdivision planning and foundation design.

An important report on groundwater and geological conditions around seventy waste disposal sites throughout the State has also been completed. This report has enabled the production of guidelines for siting and monitoring waste disposal sites to minimise the risk of groundwater pollution, which can occur when waste dumps are not properly located.

In the specialist geological area, there have been continued productivity improvements. These specialist areas include stable isotope studies, lapidary, XRD (X-ray diffraction), mineral identification, geophysical surveys and the Huminex geochemical method.

In the Coal River Valley, construction of the South East Irrigation Scheme has continued. The first half of Stage 2 is nearing completion, on time and within budget. The completion of Stage 2 in the 1990-91 year will bring irrigation water to a total of 4222 hectares.

The supply of domestic water to the Hadspen/Prospect Region will be improved substantially with the installation of the package water treatment plant at Prospect. This plant will provide temporary relief for the next few years while decisions are made on the next major augmentation of the North Esk Regional Water Scheme.

A number of initiatives had been put in train towards the end of the year, directed at achieving the benefits to be gained from the establishment of the Department.

Strong links have been developed between the Hydro-Electric Commission (HEC) and the Department, which will assist greatly in the development of energy policy and water resource management.

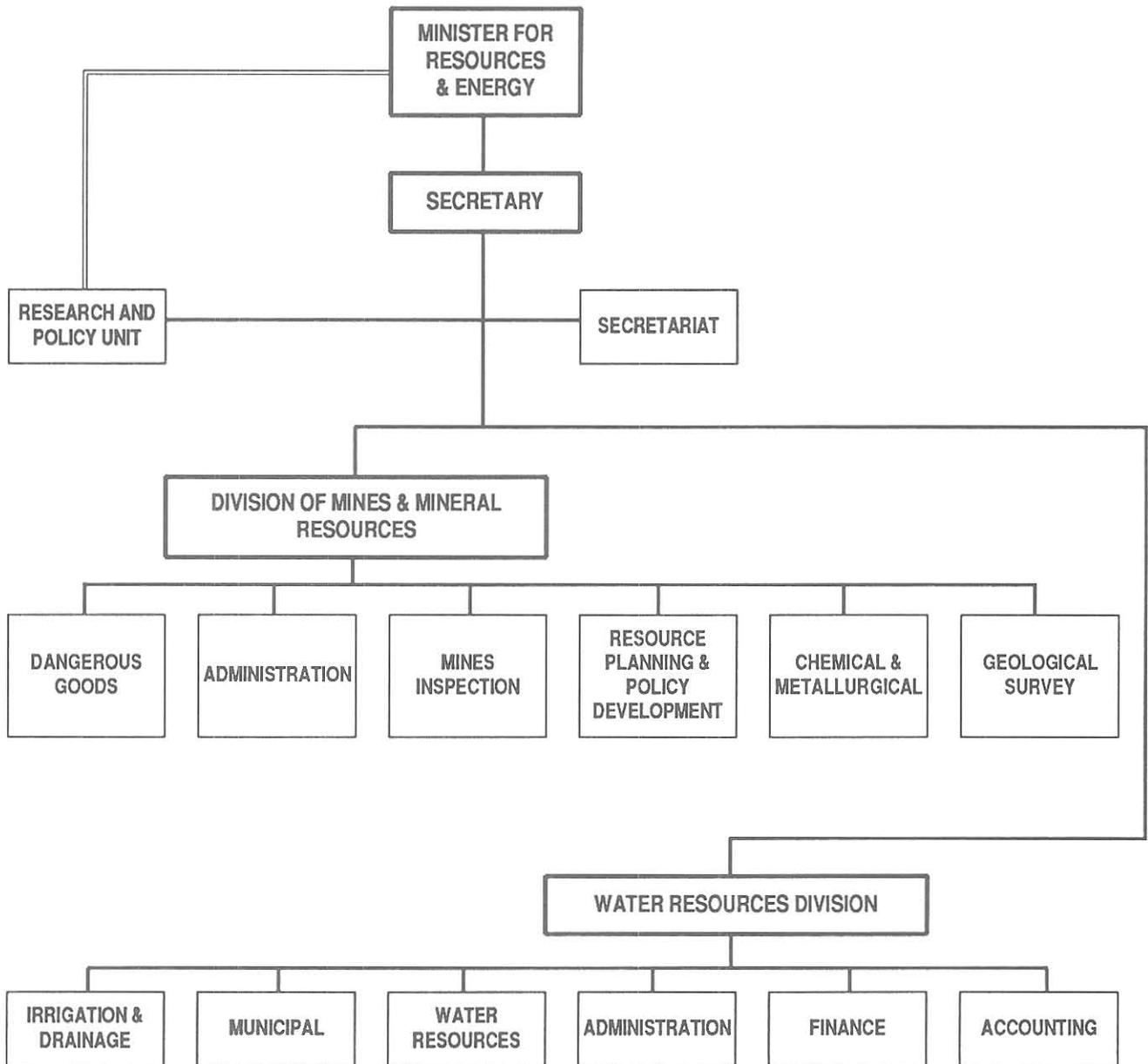
A detailed examination of various activities of the Division of Mines and Mineral Resources (Mines) and the Rivers and Water Supply Commission (RWSC) was commenced in May 1990 to determine whether changes could be made that would have lasting benefits, such as:-

- improved service to clients and to Government
- better allocation and use of human and physical resources
- reduced costs
- greater job satisfaction for staff.

This work is continuing.

Work has also commenced on reviewing the structure of the new Department. A number of working groups have been formed to examine and report on areas of overlap and duplication, and on the potential for

ORGANISATION CHART — DEPARTMENT OF RESOURCES & ENERGY



SENIOR OFFICERS

G. A. Kennedy, Secretary

Division of Mines and Mineral Resources

M. R. Hargreaves	Acting Deputy Secretary, Mines & Mineral Resources
R. Billingham	Chief Inspector of Mines
W. E. E. Lake	Chief Inspector of Dangerous Goods
A. J. Reeves	Manager – Resource Development
D. F. Spratt	Administrative Officer
D. Zani	Chief Chemist & Metallurgist

Water Resources Division

W. M. Jordan	Deputy Secretary, Water Resources, and Chairman of RWSC
G. H. Jennings	Administrative Member (RWSC)
E. V. Terry	Agricultural Member (RWSC)
P. M. Donnelly	Secretary to RWSC

Research & Policy Unit

Dr P. Burns	Director
-------------	----------

amalgamations and the consolidation of services across the Divisions. News bulletins are being circulated to all staff outlining developments as they occur. I would like to pay a special thanks to all the staff of the Department for their input and assistance in this process.

The year ahead offers continuing challenges, both in the development of the Department of Resources and Energy and in the achievement of its objectives. I am certain that the Department is well equipped to meet those challenges.

CORPORATE PLAN

THE PLANNING PROCESS

The Department of Resources and Energy has commenced the development of a Corporate Plan, whereby Executive Management will set the future direction for the organisation.

The Corporate Plan will identify and co-ordinate the planning, programming and budgetary functions which are required for the achievement of the Department's objectives.

When fully developed the Corporate Plan will provide for:-

- the establishment of corporate strategies.
- an annual review of strategies and programs.
- resource allocation against strategies and programs.
- on-going organisational, strategic and program monitoring and evaluation.

A Corporate Mission Statement and Corporate Objectives have been developed for the Department.

The major focus for the year ahead will be to develop appropriate strategies and programmes directed towards achieving the Department's objectives.

At Division level, existing business planning cycles will be reviewed and, where appropriate, modified, to conform with the overall Corporate Plan.

DIVISION OF MINES AND MINERAL RESOURCES

The aims, functions and related programmes of the Division of Mines and Mineral Resources are summarised below. Further details are provided in the Division's Annual Report, which is incorporated in this report.

AIMS

- To ensure the maximum nett benefit for the people of Tasmania from the discovery and development of the State's mineral endowment.

MISSION STATEMENT

The Mission of the Department of Resources and Energy is:-

To encourage the responsible development, management and use of mineral, energy and water resources in Tasmania.

The Mission has been endorsed by the Minister for Resources and Energy, the Hon. M. Weldon, MHA. It is the focus of directional planning for the Department.

OBJECTIVES

The Objectives flowing from the Mission Statement are:-

- (1) To further the State's economic development.
- (2) To advance:
 - (a) The long-term stability and security of energy supply and the optimum development and use of energy resources.
 - (b) The exploration and development of the State's mineral resources.
 - (c) The development, management and protection of the State's water resources.
- (3) To promote safe, responsible, efficient and effective water and mineral resource utilisation in Tasmania.
- (4) To provide the highest standard of service to and be responsive to the needs of government, industry and the people of Tasmania.
- (5) To exercise sound financial management in all areas of responsibility.
- (6) To develop and maintain the skills, motivation and professionalism of our people.

- To provide the highest standard of service and performance in all Divisional activities.
- To develop our people to their maximum potential through staff training and development.

FUNCTIONS

Existing Resources: Assure the State of the maximum utilisation of its currently-known mineral resources through effective administration of mining tenements

and inspection and monitoring of the mining and mineral-processing industries.

Undiscovered Resources: Encourage discovery of new resources by the generation of fundamental geoscientific data, and by the effective administration of the Exploration Licence and Offshore Permit Tender systems.

Environment: Minimise any environmental effects associated with exploration, mining and mineral processing within the State.

Health and Safety: Safe working practices in the mining and mineral-processing industries and in the transport, storage and use of dangerous goods are promoted and improved by inspection and education.

Scientific Services: Provide a high level of scientific expertise to advise industry, government and the public on geological mapping, geochemical surveys, geophysical surveys, drilling, groundwater studies, landslip studies, urban geotechnical data, site investigation, ore reserve assessment, metallurgical and chemical testing, mineral prospectivity, and any other specialised advice associated with geology, mining and metallurgy.

RELATED PROGRAMS

To carry out its functions, the Division of Mines and Mineral Resources administers the following programs:-

- (1) Maintenance of a high level of safety and health in the mining and mineral-processing industries by inspections, construction approvals and monitoring programmes, and by promotion of health and safety training and programs.
- (2) Minimisation through inspection the potential for any negative effects associated with the manufacture, packaging, handling, storage and transport of dangerous goods which affects public safety.
- (3) Development and implementation of mineral policies which maximise the social and economic

returns from mineral development through advice to Government on the resource impacts of land use proposals, facilitation of approvals for exploration and mining tenements, and monitoring of royalties and cost recoveries.

- (4) Monitoring and regulation of the mineral exploration industry by assessing mineral tenement applications, renewals, tender submissions and exploration reports.
- (5) Provision of a detailed historical record of all mineral exploration conducted in Tasmania and a comprehensive collection of drill core for further examination, testing and analysis by the mineral exploration industry.
- (6) Provision of up-to-date multi-purpose geological maps of the State with supporting explanatory notes and bulletins.
- (7) Investigation of the engineering properties of soils and rocks for use in land-use planning, landslip zoning, and subdivision design and approvals.
- (8) Investigation of the location, quality and extent of the groundwater resources of the State.
- (9) Provision of systematic regional coverage of gravity, magnetic, seismic, physical property and other geophysical data for use in mineral exploration and geological mapping.
- (10) Promotion of oil and gas exploration within Tasmania and its offshore waters by continuing investigation and evaluation of petroleum resources, and provision of petroleum exploration data bases.
- (11) Provision of chemical analyses services of rocks, ores, soils and waters for Government, industry and the public.
- (12) Continuation of the Mount Read Volcanics Project to progress regional knowledge of this prospective area and to promote mineral exploration.

WATER RESOURCES DIVISION

The aims, functions and related programmes of the Water Resources Division, which incorporates the Rivers and Water Supply Commission, are summarised below. Further details are provided in the Rivers and Water Supply Commission's Annual Report, which is available as a separate report.

AIMS

- To manage water catchment areas to ensure the optimal use of the State's water resources,

- To ensure the provision of efficient water-related services for a range of uses including domestic, industrial and rural water supplies, irrigation, waste disposal, recreational, flood mitigation and drainage, and conservation.

FUNCTIONS

Drainage: Ensure the natural drainage systems of the State are properly managed to protect the riverine environment and surrounding infrastructure.

Water Use: License persons to take water from rivers and lakes and prevent unlawful takings. Establish priorities in times of shortage and provide efficient management of water use.

Water Supply: Manage and maintain domestic and irrigation water supply schemes as well as Drainage and River Improvement Schemes.

Water, Sewerage and Drainage: Oversee Local Government performance of its functions in the delivery of water, sewerage and drainage services, and ensure that Municipalities are providing an efficient and effective service to their ratepayers.

RELATED PROGRAMMES

To carry out its functions, the Water Resources Division (WRD) administers the following programmes:

- (1) Regulation, control and supervision of the preparation of schemes for and the construction of any works or installations constructed by a Municipality for the purpose of supplying water or of providing sewerage or drainage facilities to or in any area or place.
- (2) Implementation of the directions of the Minister for Health on fluoridation of public water supplies by arranging for the addition of fluoride to water supplies and testing of fluoride concentration in those water supplies.
- (3) Investigating requests from Municipalities seeking financial assistance from the Government under Section 40 of the Water Act 1957 and providing advice to the Minister for his consideration when determining subsidies to be paid to Municipalities for the construction and operation of their water and sewerage undertakings.
- (4) The WRD operates hydrometric stations to provide data on the State's water resources. Investigations are also carried out into water resource use and allocation of water rights for irrigation and industrial purposes.
- (5) The WRD regulates the construction of dams for all purposes other than mining and the HEC to ensure they are constructed in such a manner as to be safe and not interfere with the rights of other water users.

- (6) The following schemes are managed and operated by the R&WSC as part of the DRE's programmes:-

Water Supply

- North Esk Regional Water Supply
- Prosser River Water Supply
- Togari Water Supply

Irrigation

- Cressy-Longford Irrigation Scheme
- Winnaleah Irrigation Scheme
- South East Irrigation Scheme

River Improvement

- Montagu River Improvement Scheme
- Western Creek River Improvement Scheme
- Lobster Rivulet River Improvement Scheme
- Rubicon River Improvement Scheme

Drainage Schemes

- Furneaux Drainage Area
- Day Point Drainage Area
- Welcome River Drainage Area

Each of these schemes is self-funding. Details of their operations are contained in the R&WSC supplement to this Annual Report.

In addition, the Rivers and Water Supply Commission owns the West Tamar Water Scheme which is managed and operated by the Beaconsfield Council on behalf of the Commission. It also operates the Prosser Scheme, which supplies water to Orford and local industry.

- (7) The DRE is represented on various agencies of the Australian Water Resources Council including Standing Committee, Water Resources Management Committee, Financial & Corporate Management Committee and Water Technology Committee, as well as being Tasmania's representative on the Australian National Committee of the International Commission on Irrigation and Drainage.

ENERGY POLICY INITIATIVES

RELATIONSHIP WITH HEC

The formation of the Department of Resources and Energy reflects the importance of resource-based industries in the Tasmanian economy and, in particular, the part energy plays in the overall economic well-being

of the State. Energy policy initiatives have traditionally evolved in Tasmania through the activities of the Hydro-Electric Commission, whereby the generating system has developed in large part to support the State's industrial growth and development.

The Department's role in the energy sector is to provide a new focus for energy policy and advice. This, of course, will involve drawing on the HEC's long-standing expertise in energy planning across a wide spectrum of potential energy sources. To this end, strong linkages, both formal and informal, have been developed between the Department and the HEC.

At the formal level, the linkage is through the appointment of the Secretary of the Department of Resources and Energy as a Commissioner of the HEC.

At the informal level, a sound working relationship has been established between the Secretary of the Department, the General Manager of the HEC, and his senior staff. Specialist HEC officers have been made available to the Department to work on specific assignments being undertaken by the Agency. These informal arrangements are efficient and cost effective. The contribution of the HEC to the development of the Department of Resources and Energy is greatly appreciated.

NATURAL GAS INITIATIVES

In November 1989 the Acting Head of Agency (Mr R. Harvey) established a Natural Gas Steering Committee to foster the development of Bass Strait natural gas for Tasmania.

The Committee comprises representatives from the Department of Resources and Energy, the Hydro-Electric Commission, and the Tasmanian Development Authority.

The status of the project at year end was as follows:

- A proposal to the Commonwealth for funding of a \$250,000 feasibility study under the TASPACT initiatives, for linking Tasmania to the national gas grid, was prepared and presented. The proposal was declined by the Commonwealth.
- A market assessment had been completed. A reasonable market for natural gas is considered to exist, subject to gas being available at a competitive price sufficient to attract new industry and support the establishment of a thermal power station.
- Negotiations for the supply of natural gas had been entered with two prospective suppliers:
 - SAGASCO (from the Yolla field north of Burnie).
 - ESSO/BHP (from the Gippsland Basin in Victoria).

Further exploration work is required to prove-up the Yolla reserves. This work is contingent upon firm gas sales being available.

- Proposals had been sought from Consultants to study and report on a number of issues associated with the introduction of natural gas to Tasmania. Capel Court Corporation has since been appointed to carry out these studies under the leadership of Mr M. Lauer.

The Committee is continuing to pursue all available avenues with the objective of achieving the conditions which will enable gas to be available in Tasmania at the earliest possible date.

TARIFF REVIEW CONSULTANCY

Early in 1990 the Government decided to carry out a detailed review of the HEC's current energy costing and pricing policies. A Tariff Review Steering Committee, comprising Dr Penny Burns (Department of Resources and Energy), Mr Noel Kerrison (Hydro-Electric Commission) and Mr Robert Rutherford, Chairman (Economic Advisor to the Premier), was appointed to undertake the review and report back to Government.

The study is being conducted in two stages.

Stage 1 comprises a preliminary overview of the current situation, including existing costing and pricing practices of the HEC, designed to identify the important issues to be addressed in *Stage 2*.

Stage 2 will comprise a detailed analysis of current costs and charges, and the development of recommendations for new tariff strategies and their implementation.

At year end invitations had been extended to selected consultants to submit proposals for *Stage 1* of the work. The Tellus Institute (Boston, Massachusetts, USA) was selected for the *Stage 1* work. Their report has since been released by the Minister for Resources and Energy for public comment.

ENERGY EFFICIENCY CONSULTANCY

Early in 1990 the Government decided to review the overall usage of electrical energy in Tasmania. A Steering Committee, comprising members of the Tariff Review Committee, together with Mr Graeme Kennedy, Chairman (Secretary, Department of Resources and Energy), was appointed to undertake the review and report back to Government.

At year end invitations had been extended to selected consultants to submit proposals for the work.

Dr F. P. Sioshansi, of Southern California Edison Company, has since been appointed to undertake the work. His report is expected to be submitted to the Minister for Resources and Energy by mid-November 1990.

REPORT ON FINANCIAL ACTIVITIES

The accompanying financial statements of the Department of Resources and Energy have been prepared in compliance with the provisions of the Financial Management and Audit Act 1990 and are in agreement with the relevant accounts and records so as to present fairly the financial transactions for the 12 months ending 30 June 1990 and the financial position as at 30 June 1990.

At the date of signing I am not aware of any circumstances which would render the particulars included in the financial statements misleading or inaccurate.



G. A. KENNEDY

SECRETARY

NOVEMBER 1990

RESOURCES AND ENERGY

Table A

Division 20

SUMMARY OF EXPENDITURE
AND RECEIPTS

YEAR ENDED 30 JUNE 1990

EXPENDITURE

1988/89 Actual \$		Estimate \$	1989/90 Actual \$	Variation \$
6 714 869	Mines and Mineral Resources	7 404 000	7 654 194	+250 194
5 944 235	Rivers and Water Supply	7 346 000	7 198 000	-148 000
50 000	Hydro-Electric Commission	-	-	
	Enterprises Corporation			
12 709 104	Total Expenditure	14 750 000	14 852 194	+102 194

RECEIPTS

1 570	Y207 Sale of Government Properties	-	613	+613
1 094 649	Y208 Rent and Fees from Mineral Lands	1 100 000	845 742	-254 258
352 564	Y209 Royalties on Iron Ore Pellets	400 000	334 116	-65 884
177 386	Y210 Storage of Explosives and Flammable Liquids	180 000	174 623	-5 377
3 446 689	Y212 Mineral Royalties	7 000 000	6 060 036	-939 964
517 408	Y337 Resources and Energy	712 000	461 621	-250 379
8 265	L800 Sale of Government Assets	-	71 989	+71 989
5 598 531	Total Receipts	9 392 000	7 948 740	-1 443 260

DIVISION OF MINES AND MINERAL RESOURCES

1. HIGHLIGHTS

The Division completed the year within budget. However, additional funds were provided for national wage adjustments and for modification of the phasing of construction of the new core library.

Two additional government grants to the University of Tasmania were added to the Division's budget during the year. These funds were initially allocated to the Office of Science and Technology, which was absorbed into the TDA. Details are:-

- National Centre for Ore Deposits and Exploration Studies. \$50,000 p.a. in 1989/90 terms, indexed, over 6 years.
- Seismic Net Maintenance — \$16,000 p.a. in 1989/90 terms, indexed over 3 years.

2. ECONOMIC FACTORS

Most revenue items associated with the mining activities of the Division of Mines and Mineral Resources, such as royalties and rents, are dependent on the levels of profits and activity within the mining and mineral exploration industries.

As levels of profits and activity are largely controlled by international factors, such as metal prices, commodity stocks and supplies, and currency fluctuations, revenue forecasts are extremely difficult to make with any degree of certainty.

In past years the royalty regime has been entirely profit based, and the estimation of royalty payments has therefore been extremely difficult.

The new royalty arrangements, which come into force in July 1990, have both an *ad valorem* and a profit component. A more stable revenue base is thereby assured in relation to sales, while enabling the State to participate more in periods of high profitability. The new royalty arrangements will also facilitate revenue estimation.

3. PRICING AND CHARGING

Divisional policy is to regularly review all fees and charges and to set them at levels which reflect the costs associated with the delivery of service.

Consultation charges for services by the Geological Survey and the Laboratories are set within the upper quartile of industry charges.

Progressive increases over a number of years in the rates of fees and charges have been designed to move to full cost recovery of direct services provided. This process is now largely complete.

4. CAPITAL PROJECTS

The Division has had only one capital project recently — the construction of a new diamond-drill core store. This is to meet the statutory requirement of maintaining a drill core archive of mineral exploration in the State. The building was completed in mid-1990 at a total cost of \$615,000. A further \$247,000 has been allocated for the purchase and installation of core-tray racking, and landscaping costs of \$18,000.

Initially designed in two stages to meet cash flow restrictions, the project was modified with Stage 2 immediately following Stage 1 to achieve design and construction savings. The associated costs were:-

Stage 1 (contract price)	\$387,216
Original Stage 2 (pre-tender estimate)	\$267,500
Amended Stage 2	\$227,356

5. PERFORMANCE INDICATORS

The Division has had a monthly financial reporting system for some years, which measures performance against budget and revenue estimates.

6. RISK MANAGEMENT POLICIES

A series of checks and balances are currently in place for receiving monies, issuing orders, and paying invoices.

7. ASSET MANAGEMENT POLICIES

A regime of asset and inventory controls is currently in place within the Division.

RESOURCES AND ENERGY

Table B

Division 20
Program 1 — Mines and Mineral Resources

CONSOLIDATED FUND — EXPENDITURE

YEAR ENDED 30 JUNE 1990

1988/89 Actual \$		Estimate \$	1989/90 Actual \$	Variation \$
	Program: 1			
	Mines and Mineral Resources			
	Recurrent Services			
5 384 437	A100 Operating Expenses	5 509 000	5 598 994	+89 994 ¹
3 939	C007 Consultants	4 000	4 000	
60 957	C050 Equipment and Stores	61 000	61 000	
82 987	C135 Drilling and Boring: Incidental Expenses	83 000	83 000	
58 000	C136 Laboratories	78 000	78 000	
50 000	C603 Tasmanian Government Research Scholarships	50 000	50 000	
480 000	C772 Mt Read Volcanics Project	450 000	456 000	+6 000
-	C828 National Centre for Ore Deposits and Exploration Studies: Grant	-	50 000	+50 000 ²
-	C830 Seismic Net Maintenance	-	17 200	+17 200 ²
6 120 320	Total Recurrent Services	6 235 000	6 398 194	+163 194
	Works and Services			
44 999	F100 Building Construction and Associated Expenses	569 000	656 000	+87 000 ³
549 550	H100 Other Works and Purposes	600 000	600 000	
594 549	Total Works and Services	1 169 000	1 256 000	+87 000
6 714 869	Total Payments for Program	7 404 000	7 654 194	+250 194

NOTES:

(1) NWC Effect

(2) Transferred from TDA

(3) Adjustment to cash flow for construction of new core store

RESOURCES AND ENERGY

Table C

Division 20
Program 1 — Mines and Mineral Resources

CONSOLIDATED FUND — RECEIPTS

YEAR ENDED 30 JUNE 1990

RECURRENT — State

1988/89 Actual \$		Estimate \$	1989/90 Actual \$	Variation \$
1 570	Y207 <i>Sale of Government Properties</i>	-	613	+613
<hr/>				
Y208 <i>Rent and Fees from Mineral Lands</i>				
381 156	Lease Rentals	390 000	391 306	+1 306
5 040	Submerged Land Rentals	6 000	4 605	-1 395
134 626	Submerged Lands Other Fees	50 000	29 758	-20 242
78	Application Rents	500	400	-100
73 784	Mining Fees	100 000	74 357	-25 643
1 360	Miners Rights	1 500	1 405	-95
3 280	Prospectors Licences	4 000	6 580	+2 580
265 101	Exploration Licences	300 000	148 892	-151 108
2 936	Transfer Fees	4 000	2 937	-1 063
1 295	Application Fees	3 000	(1 280)	-4 280
72 998	Search Fees under Mining Act	70 000	59 555	-10 445
365	Mine Managers' Certificates	600	1 279	+679
29 365	Sale of Maps & Publications	35 000	23 358	-11 642
123 265	Assay Fees	135 400	102 590	-32 810
1 094 649		1 100 000	845 742	-254 258 ¹
<hr/>				
352 564	Y209 <i>Royalties on Iron Ore Pellets</i>	400 000	334 116	-65 884 ²
<hr/>				
Y210 <i>Storage of Explosives & Flammable Liquid</i>				
55 090	Licence to keep flammable liquids and LPG	55 000	55 785	+785
825	Licence to export and import	800	825	+25
475	Licence to convey explosives	500	425	-75
3 440	Licence to sell explosives	3 400	3 320	-80
50	Licence to manufacture explosives	100	50	-50
12 488	Licence to sell fireworks	12 000	11 334	-666
455	Shot firers permits	600	637	+37
20 790	Inspection fees	22 000	18 000	-4000
7 060	Applic. for approval for construction or alteration to premises	6 500	7 255	+755
2 159	Other fees or permits	500	1 415	+915
68 473	Storage of explosives	72 000	69 789	-2211
2 600	Licence for private magazine	3 000	2 635	-365
305	Licence to manufacture dang. goods	300	305	+5
425	Licence to import dangerous goods	200	425	+225
100	Gas suppliers licence	100	100	-
2 651	Landing fees	3 000	2 323	-677
177 386		180 000	174 623	-5 377

RESOURCES AND ENERGY

Table C

Division 20
Program 1 — Mines and Mineral Resources

CONSOLIDATED FUND — RECEIPTS

YEAR ENDED 30 JUNE 1990

RECURRENT — State				
1988/89 Actual \$		Estimate \$	1989/90 Actual \$	Variation \$
	<i>Y212 Mineral Royalties</i>			
3 318 495	Metallics	6 700 000	6 126 047	-573 953
<u>139 866</u>	Less refunds		<u>376 000</u>	-376 000
3 178 629			5 750 047	
268 060	Other	300 000	309 989	+9 989
<u>3 446 689</u>		<u>7 000 000</u>	<u>6 060 036</u>	<u>-939 964³</u>
	<i>Y337 Resources & Energy</i>			
246 351	Drilling debtors	290 000	225 186	-64 814
66 877	Geological services	80 000	121 116	+41 116
7 994	Mt Read fees	10 000	5 474	-4 526
—	Geological search fee	250 000	33 838	-216 162
<u>321 222</u>		<u>630 000</u>	<u>385 614</u>	<u>-244 386⁴</u>
5 392 510	Total Recurrent Receipts	9 310 000	7 800 744	-1 509 256
CAPITAL — State				
8 265	<i>L800 Sale of Government assets</i>	—	71 989	+71 989
<u>8 265</u>	Total Capital Receipts	<u>—</u>	<u>71 989</u>	<u>+71 989</u>
5 400 775	TOTAL RECEIPTS	9 310 000	7 872 733	-1 437 267

NOTES:

- (1) Y208 — Revenue gained to cover a proportion of costs associated with the administration of mining legislation and services to the industry. The level of revenue is dependent on industry activity, and the reduction of \$254 258 reflects a downturn in Exploration Licence applications, reduced interest in Offshore Petroleum Permits and Mining Leases, as well as sale of maps and publications and searches on real estate movements.
- (2) Y209 — This reduction reflects the withdrawal of Japanese interests and the continuation of Savage River at reduced output levels.
- (3) Y212 — See comments in paragraph 2 of "Report on Financial Activities".
- (4) Y337 — This reduction is due to the non-implementation of a fee for service relating to geological assessments of subdivision proposals.

RESOURCES AND ENERGY

Table D

Division 20
Program 1 – Mines and Mineral Resources

SPECIAL DEPOSITS AND TRUST FUND

T466 DEPOSIT ACCOUNT

STATEMENT OF RECEIPTS AND EXPENDITURE FOR YEAR ENDED 30 JUNE 1990

FUNCTION AND PURPOSE OF ACCOUNT

Amounts are received from individuals and companies as security against failure to perform or rehabilitate leases and licences under the Mining Act. Amounts are returned when leases or licences are cancelled or replaced by a bank guarantee. In the event of failure to rehabilitate the lease or licence area the deposit is forfeited and transferred to T757 Forfeited Performance Deposit Account.

1988/89		\$	1989/90
Actual \$		\$	Actual \$
276 500	Opening Balance		239 525
23 925	Receipts Deposits received	77 050	77 050
300 425	Total receipts		316 575
60 900	Less Expenditure Deposits refunded	120 050	
-	Deposits forfeited	12 000	
60 900	Total payments		132 050
239 525	Closing Balance		184 525

RESOURCES AND ENERGY

Table D

Division 20
Program 1 – Mines and Mineral Resources

SPECIAL DEPOSITS AND TRUST FUND

**T281 SMALL TIN MINERS
ASSISTANCE SCHEME**

**STATEMENT OF RECEIPTS AND EXPENDITURE FOR YEAR
ENDED 30 JUNE 1990**

FUNCTION AND PURPOSE OF ACCOUNT

The Commonwealth appropriated moneys to provide assistance of \$79,700 to the State to enable the State to pay a subsidy to small tin mine operators.

The financial assistance was by way of a non-repayable, non interest bearing grant. The subsidy payable by the State to small tin operators is subject to the following conditions.

In the case of borrowing up to a maximum of \$20,000 — 50% of interest payments on loans or leases on borrowing by eligible small tin mine operators since 24 October 1985 but shall not exceed an amount of \$8000 in respect of any one small tin mine.

Applications were considered within a three year period commencing on 1 October 1986 and the State repaid \$35,060 of uncommitted amounts as at 30 September 1989 to the Commonwealth. The State is not entitled to any assistance under this scheme.

1988/89		1989/90
Actual \$		Actual \$
69 871	Opening Balance	67 730
	Receipts	
69 871	Total receipts	67 730
	Less Expenditure	
2 141	Subsidy to small-scale tin miners	2 067
-	Repayment to Commonwealth Government	35 060
2 141	Total payments	37 127
67 730	Closing Balance	30 603

RESOURCES AND ENERGY

Table D

Division 20
Program 1 – Mines and Mineral Resources

SPECIAL DEPOSITS AND TRUST FUND

T741 GORDON RIVER POWER DEVELOPMENT

STATEMENT OF RECEIPTS AND EXPENDITURE FOR YEAR ENDED 30 JUNE 1990

FUNCTION AND PURPOSE OF ACCOUNT

The Mt Read Project commenced in 1985/86 when Cabinet approved the allocation of \$2 million from the Gordon River Power Development compensation account. Since then amounts have been transferred from the Consolidated Fund each financial year to this Trust Fund. The Mount Read Volcanics Project represents a major Government initiative designed to encourage maximum private sector mineral exploration effort in probably the most productive and prospective rock unit in Australia by provision of innovative regional geological, geophysical and geochemical information.

1988/89		\$	1989/90
Actual \$			Actual \$
10 725	Opening Balance		10 782
	Receipts		
480 000	Government Grant	456 000	456 000
490 725	Total receipts		466 782
	Less Expenditure		
147 182	Salaries	373 461	
21 161	Travelling expenses	14 568	
3 922	Motor vehicle expenses	1 169	
19 458	Map purchases	16 670	
12 409	Photographic expenses	10 803	
15 246	Purchase of minor equipment	6 139	
255 835	Purchase of major equipment	-	
4 730	Expendables	30 680	
479 943	Total payments		453 490
10 782	Closing Balance		13 292

RESOURCES AND ENERGY

Table D

Division 20
 Program 1 – Mines and Mineral Resources

SPECIAL DEPOSITS AND TRUST FUND

**T757 FORFEITED PERFORMANCE DEPOSITS
 ACCOUNT**

**STATEMENT OF RECEIPTS AND EXPENDITURE FOR YEAR
 ENDED 30 JUNE 1990**

FUNCTION AND PURPOSE OF ACCOUNT

Funds are provided from the forfeiture of mining companies performance deposits. Payments are made for the cost of the physical examination of mining exploration sites for the purpose of restoration.

1988/89		\$	1989/90
Actual			Actual
\$			\$
8 006	Opening Balance		12 561
9 200	Receipts Deposits forfeited	40 500	40 500
17 206	Total receipts		53 061
4 645	Less Expenditure Restoration costs	25 509	
4 645	Total payments		25 509
12 561	Closing Balance		27 552

RESOURCES AND ENERGY

Table D

Division 20
Program 1 – Mines and Mineral Resources

SPECIAL DEPOSITS AND TRUST FUND**T752 MINING TRUST FUND****STATEMENT OF RECEIPTS AND EXPENDITURE FOR YEAR
ENDED 30 JUNE 1990****FUNCTION AND PURPOSE OF ACCOUNT**

Provides assistance by means of loans to individuals and companies for the purpose of mining. Amounts are received from repayment of loans, interest and Commonwealth Government subsidies. Funding is by means of the Consolidated Fund Appropriation.

1988/89			1989/90
Actual \$		\$	Actual \$
123 832	Opening Balance		108 866
	Receipts		
6 037	Repayment of loans	7 374	
3 856	Repayment of interest	8 886	
2 141	Commonwealth subsidy	2 068	18 328
135 866	Total receipts		127 194
	Less Expenditure		
27 000	Assistance to individuals and companies	20 000	
27 000	Total payments		20 000
108 866	Closing Balance		107 194

WATER RESOURCES DIVISION

1. HIGHLIGHTS

The Division completed the year within budget, with operating expenses totalling \$1,664,000. Other expenditure included:-

- \$2,114,829 on subsidies to municipalities for the construction and/ or operation of schemes for the supply of water or the provision of sewerage and drainage facilities.
- \$946,190 paid to municipalities from the "Country Town Water Supply Improvement Program" Trust Account, which was credited in 1989-90 with \$258,000 received from the Commonwealth Government and \$212,667 transferred from the Consolidated Fund.
- \$2,686,079 being for the reimbursement of principal and interest charges incurred by the Commission on loans raised for the construction of the South East Irrigation Scheme (\$1,501,267), Winnaleah Irrigation Scheme (\$961,944), and Meander Valley Irrigation Scheme (\$222,868).
- \$85,403 for the costs of stream gauging instruments, back record processing, and archiving.
- \$42,809 for the costs of investigations of water conservation schemes and floodplain mapping.
- \$44,635 for the Government contribution to capital costs, shared by landowners, of land drainage and flood prevention works on the Furneaux Drainage Scheme and the North Esk River.

2. ECONOMIC FACTORS

There were no significant factors which affected the Commission's operations in 1989-90.

3. PRICING AND CHARGING

In 1989-90 partial recovery of management costs associated with Commission Water Rights, operation and maintenance of non-Rivers and Water Supply Commission stream gauging stations, and trading scheme cost recovery was attained.

Revenue totalling \$76,006 was received in 1989-90.

4. CAPITAL PROJECTS

Information on major capital projects in relation to the Commission's trading schemes is contained in the Rivers and Water Supply Commission's Annual Report for the year 1989-90.

5. PERFORMANCE INDICATORS

The performance of the Division against budget is reviewed regularly by the Commission at its monthly meetings.

No specific performance indicators have been introduced at this stage.

6. RISK MANAGEMENT POLICIES

Accounting and financial procedures are reviewed regularly for internal control maintenance.

7. ASSET MANAGEMENT POLICIES

The Commission maintains an inventory control system which is updated regularly.

RESOURCES AND ENERGY

Table B

Division 20
Program 2 — Water Resources

CONSOLIDATED FUND — EXPENDITURE

YEAR ENDED 30 JUNE 1990

1988/89 Actual \$		Estimate \$	1989/90 Actual \$	Variation \$
	Program: 2			
	Rivers and Water Supply Commission			
	Recurrent Services			
1 499 688	A100 Operating Expenses	1 641 300	1 664 000	+22 700
245 757	C103 Interest on borrowings for minor works	297 000	270 000	-27 000
1 580 072	C546 Local authorities: subsidies under the Water Act 1957	2 455 700	2 328 000	-127 700
-	C547 River improvement schemes: subsidies under the Water Act 1957	1 000		-1 000
-	C548 Drainage trusts: assistance for maintenance	1 000		-1 000
2 411 813	C549 Construction of irrigation schemes: loan charges subsidies	2 700 000	2 686 000	-14 000
<hr/> 5 737 330	Total Recurrent Services	<hr/> 7 096 000	<hr/> 6 948 000	<hr/> -148 000
	Works and Services			
206 905	H100 Other Works and Purposes	250 000	250 000	
<hr/> 206 905	Total Works and Services	<hr/> 250 000	<hr/> 250 000	
<hr/> 5 944 235	Total Payments for Program	<hr/> 7 346 000	<hr/> 7 198 000	<hr/> -148 000

RESOURCES AND ENERGY

Table D

Division 20
Program 2 – Water Resources

SPECIAL DEPOSITS AND TRUST FUND

**T697 COUNTRY TOWNS WATER SUPPLY
IMPROVEMENT PROGRAM (COWSIP) ACCOUNT**

**STATEMENT OF RECEIPTS AND EXPENDITURE FOR YEAR
ENDED 30 JUNE 1990**

FUNCTION AND PURPOSE OF ACCOUNT

To receipt both Commonwealth and State COWSIP contributions and make appropriate payments to Municipalities for approved COWSIP projects and other special projects approved by the State.

1988/89			1989/90
Actual		\$	Actual
\$			\$
16 396	Opening Balance		586 205
	Receipts		
285 667	Commonwealth	258 000	
377 000	State	212 667	
662 667	Total receipts		470 667
679 063	Funds Available		1 056 872
	Less Expenditure		
84 259	COWSIP Projects	942 637	
8 599	State Project (Strahan Sewerage)	3 553	
92 858	Total payments		946 190
586 205	Closing Balance		110 682

EXPLANATION OF VARIATION

CONSOLIDATED FUND EXPENDITURE

ITEM: C546 LOCAL AUTHORITIES: SUBSIDIES UNDER THE WATER ACT 1957

The qualifying standards for determining water and sewerage subsidies in 1989–90 were increased by 7.1% in line with the movement of average weekly earnings at November annually, as published by the Australian Bureau of Statistics. The effect of this increase was to reduce the dependence on subsidies for some schemes. However, increased costs, extensions and new facilities increased some subsidy allocations.

The total amount of subsidies paid in 1988–89 was \$1,580,072 and the amount paid in 1989–90 was \$2,328,000, an increase of \$747,928.

The major increases were as follows:—

Smithton Sewerage

Included a provision to increase the maximum subsidy payable from 20% of operating costs to 27½% to further assist the Circular Head Municipality to provide adequate sewerage facilities.

Kingborough Sewerage

Included arrears of subsidy for 1988–89 amounting to \$251,792 for existing works.

St Helens Sewerage

Provision was made for a new maximum subsidy level.

North West Regional Water Scheme

There was an increase in the basic cost of water from 53.134 cents/kL in 1988–89 to 66.419 cents/kL in 1989–90.

Hobart Regional Water Scheme

Increased costs associated with the provision of new reservoirs.

ITEM: Y337 RESOURCES AND ENERGY

Actual receipts in 1988–89 were \$196,300 compared with actual receipts of \$76,006 in 1989–90, a decrease of \$120,294. In 1989–90 profits from the North Esk Regional Water Supply were credited to this item. Scheme profits credited were approximately \$162,000. In subsequent years profits from the North Esk Regional Water Supply have been credited to Treasury Item Y309.

REPORT OF THE DIVISION OF MINES AND MINERAL RESOURCES 1989–90

To the Hon. Michael W. Weldon, Minister for Resources and Energy.

Annual Report of the Division of Mines and Mineral Resources for 1989–90 submitted by the Acting Director of Mines, M. R. Hargreaves.

OVERVIEW

The year 1989–90 has been a satisfactory one for the State's mining and metallurgical industries. Following the record year of 1988–89, the value of production of Tasmanian ores increased from \$588M to \$620M, i.e. by 5.4%. However, metallurgical production from imported ores was reduced from \$818M to \$739M, i.e. 9.7%.

The overall value of all mining and metallurgical production in the State decreased by 3.3% from \$1406M to \$1359M, and the number of employees was reduced by 11.2% from 7770 to 6897.

Production rates of the various mineral commodities won from within the State had mixed results during the year. There were decreases in the production of copper (10.1%), zinc (9.7%), tungsten (13.2%) and gold (17.5%). Increased production rates were achieved in tin (15.9%), lead (46.8%) and silver (28.6%). The overall improvement of the value of metallic minerals produced was largely the result of firmer metal prices and a more favourable exchange rate.

The value of non-metallic and fuel mineral production increased significantly during the year from \$30.6M to \$38.6M (26.1%). The positive result was largely due to

the increased tonnages of limestone extracted for fertilizer and cement production.

The total value of construction materials extracted during the year increased marginally, from \$24.3M to \$25.7M (5.8%).

The industry continues to expend capital, on mines and works, to improve productivity and to reduce costs, and to improve environmental performance.

REVIEW OF DIVISIONAL ACTIVITIES

The year in review has been one of achievement for the Division. Through the year there have been numerous examples of innovation and improvement in productivity and service delivery, using the same, and in some cases reduced, staff resources.

Within the Resource Planning and Policy Development Branch, in partnership with the Geological Survey, significant resources have been dedicated to the ongoing development of Divisional geoscientific data bases and the Geographic Information System. Increased computerisation of the Registrar's office will result in a comprehensive tenement data base which will ultimately be integrated with spatial and scientific data. The State 1:500 000 scale geological map has been digitised and incorporated into the GIS system. The digital capture of the Launceston Sheet, the first of the nine 1:250 000 scale geological maps which cover the State, has begun, incorporating the most up-to-date 1:50 000 data.

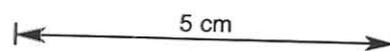
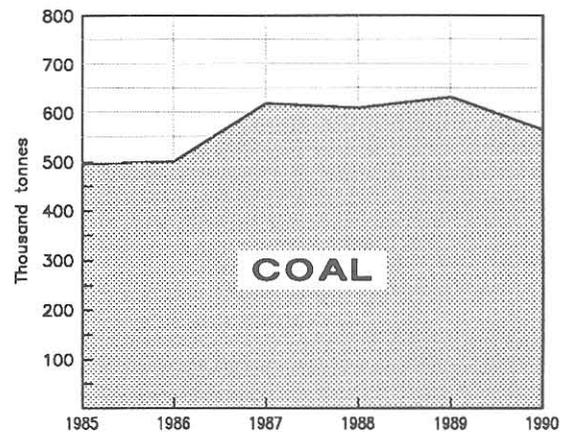
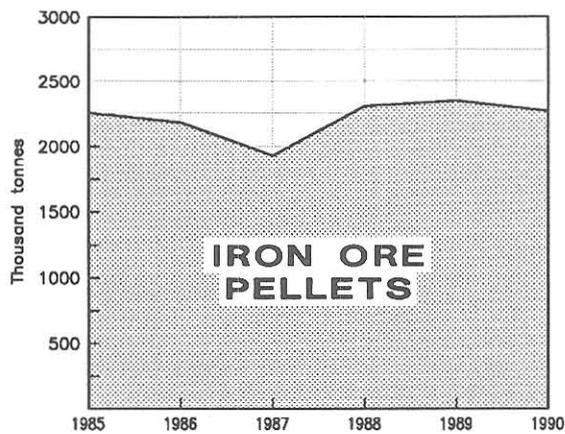
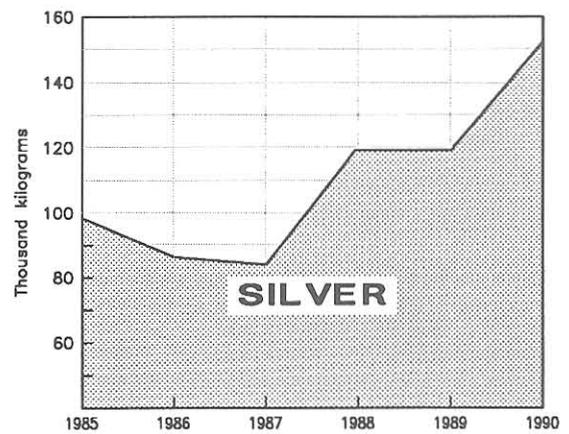
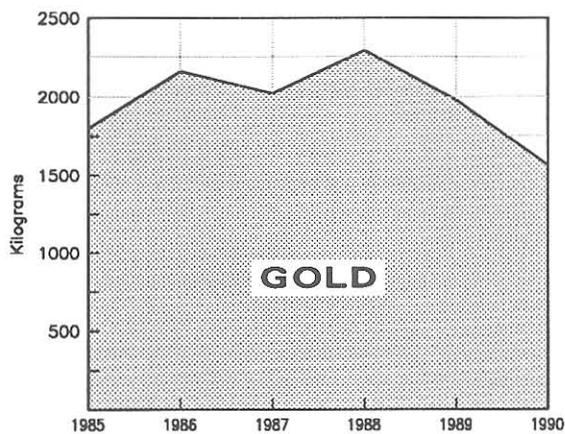
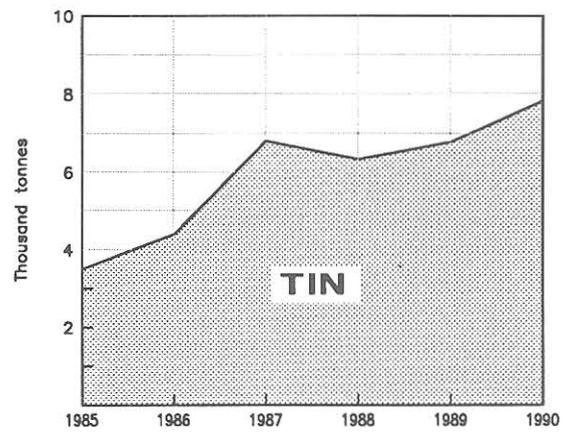
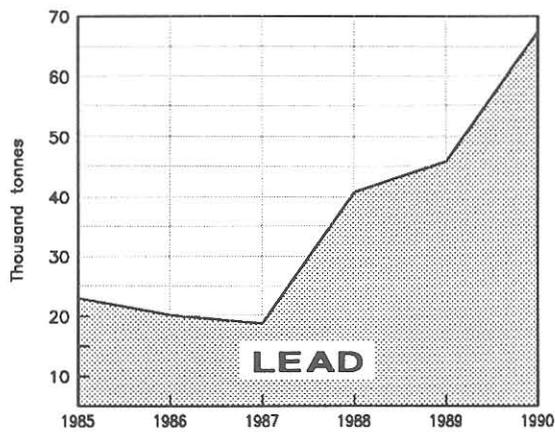
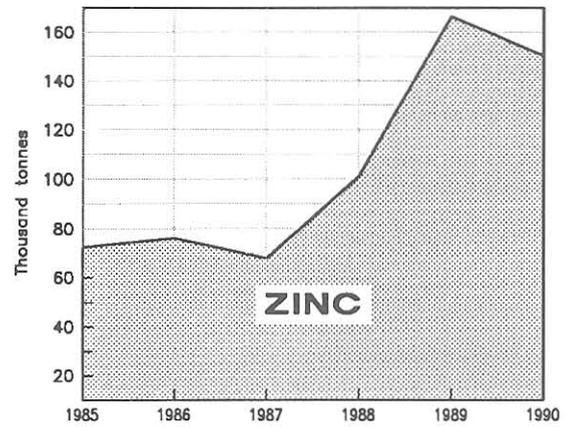
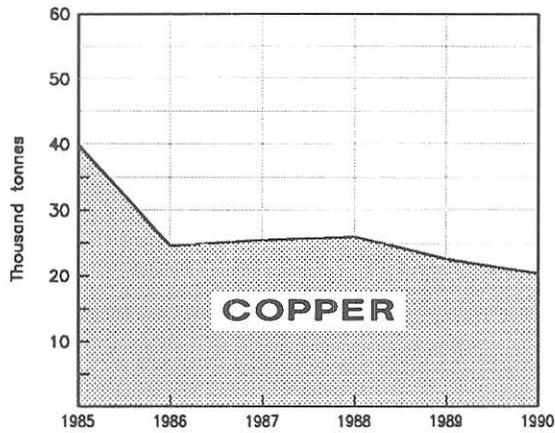
The Environmental Geology Section, in conjunction with the Chamber of Mines, has completed a series of

Table 1

VALUE AND PRODUCTION OF PRINCIPAL MINERALS

Commodity	Quantity	Value (\$M)
Copper (tonnes)	20 045	40.15
Gold (kg)	1 627	19.88
Iron ore pellets (tonnes)	2 260 774	81.21
Lead (tonnes)	67 020	60.79
Silver (kg)	154 369	22.70
Tin (tonnes)	7 903	73.04
Tungsten as tungstic oxide (tonnes)	1 531	11.66
Zinc (tonnes)	150 413	222.79
Coal — run of mine	569 173	-

PRODUCTION OF PRINCIPAL MINERALS



field investigations of historic mining sites to catalogue areas of archaeological interest and to determine potential rehabilitation programme requirements.

Following the filling of vacant positions, the Mines Inspectorate has been able to be more active in site inspections, especially in occupational health, atmospheric surveys, and in conducting training. An extremely encouraging result during the year was the reduction of lost-time injury frequency rates by 33% to the lowest annual result on record. This result indicates that the efforts of management, employees and the inspectorate to improve safety are having a positive effect.

The Dangerous Goods Inspectorate has also been able to increase its training activities, and has been instrumental in the development, organisation and implementation of:-

- The Tasmanian Road Transport Industry Training course for drivers of dangerous goods vehicles.
- Shotfirers courses and examinations.
- Agricultural and Veterinary Chemicals Association training courses.

The Geological Survey Branch has continued its programme of multi-purpose 1:50 000 scale geological mapping with field work being undertaken on the Woolnorth, Dover, Alberton, Point Hibbs, Styx, Trowutta, Swansea and Zeehan maps. Significant resources have also been dedicated to the provision of prospectivity assessments of a large number of areas in the State as part of the Forest Protection and Forest & Forest Industry Strategy processes. Major groundwater studies are in the process of completion for the Sheffield, Tamar and East Coast areas. A survey of the groundwater effects of the various refuse disposal sites throughout the State was completed, as were guidelines for the siting of new tip sites to minimise the risk of groundwater pollution.

A very encouraging development was the increase in revenue from geological consulting of over 80% to \$121,000.

The Chemical and Metallurgical Laboratory had a year of mixed results, with an overall increase in the work done by 6.4% to \$189,288 but a reduction of work completed for industry of 9.2% to \$118,000, offset by an increase in geological survey work.

AUSTRALIAN MINERALS AND ENERGY COUNCIL

Tasmania hosted the twentieth meeting of the Australian Minerals and Energy Council (AMEC) in Hobart on 4 August 1989.

The Council, comprising Ministers of all States, the Northern Territory, and the Commonwealth, with New Zealand attending as an observer, meets on a six to nine month basis for discussions on material issues affecting the industry. Multiple land use policy was the principal theme of the discussion, and Ministers unanimously supported the National Conservation Strategy, adopted in 1984 after extensive consultation with Governments, industry groups, and environmental bodies.

The States and Northern Territory expressed a united concern that despite their general support to Multiple Land Use policies the concept was not being afforded a wide acceptance in Australia.

The establishment of the Resources Assessment Commission was welcomed, with the hope expressed that it will provide a mechanism for obtaining facts necessary for sensible land use decisions affecting both development and the environment.

An in-camera session provided Ministers with the opportunity for informal discussion on major economic and social issues.

Ministers also considered papers dealing with taxation regimes on the gold and petroleum sectors, and noted reports of standing committees on transport costs, Commonwealth/State co-operation on mineral development, alternative fuels, and the greenhouse effect.

RESOURCE PLANNING AND POLICY DEVELOPMENT

Activities in the Branch were dominated by the requirement to input into Government land-use decisions. The Branch and the Geological Survey prepared advice for Cabinet on the mineral reserve potential of areas under consideration for World Heritage listing and National Park status. Attention focussed on the highly prospective sequences of the Mt Read Volcanics and granite-related mineralisation of western Tasmania, limestone resources in the vicinity of Lune River, the Adamsfield ultramafic rocks and associated platinoid-bearing alluvial materials, and coal reserves under the proposed Douglas-Apsley National Park.

In addition, advice was provided on the impact on mineral development of land use proposals of other agencies for protection of forest classes. These issues highlighted the necessity for a methodology to assess undiscovered mineral resource potential, and the Branch has now adopted a model for future land use decisions.

Implementation of Government policy required the revocation of a mining lease in the Franklin-Lower Gordon Wild Rivers National Park, and a series of studies were initiated to determine the environmental, economic and social impact of the future operations of a quarry included in the expansion of the World Heritage Area.

RESOURCE DEVELOPMENT

Discussions with the managing agent of the Savage River Mines joint venture Pickands Mather & Co. International led to a decision by the managing agent to acquire all equity in the project and to continue operations at a reduced scale of output beyond the scheduled closure date of October 1990.

Discussions were held with developers on approvals processes for an underground gold mine and a mineral sands venture.

The Branch continues its principal role of facilitating mineral resource development, and has promoted informal discussions between project proponents and relevant Agencies and members of the public to conciliate on issues of concern.

ROYALTIES AND FEES REVIEW

Following a detailed review of the structure of mineral royalties, new arrangements were set in place to take effect from 1 July 1990. Fees for mining tenement transactions were also reviewed to remove anomalies and to maintain recovery of administration costs.

COMPUTER SERVICES

The Computer Services Branch has increased its staff with the addition of a Computer Systems Officer Grade II. A new system has been developed including a receipting facility and will improve productivity by eliminating many manual operations. Tasks for 1990-91 include investigations into financial systems and the ongoing development of Divisional databases. Increased computerisation of the Registrar's office will result in a comprehensive tenement data base which will ultimately be integrated with spatial and scientific data.

The Branch has advanced significantly in the development of a geographic information system (GIS). Some achievements include the creation of a digital tenement data base, the completion of the digital 1:500 000 geological map, and the collection of many other data sets through liaison with other Agencies. A second GIS work station will soon be available for the capture of the 1:250 000 geological maps. The GIS has enabled the Branch to amalgamate information from various sources in order to provide timely and informative responses to many land use policy decisions.

REGISTRAR'S OFFICE

In parallel with computerisation of tenement records, the Registrar has introduced major changes to facilitate the efficient processing of transactions. Without these changes, the Registrar's office with current resources would be poorly equipped to deal with the increased reporting requirements and demand for policy advice on tenement transactions.

RESOURCE DRAFTING

The section has been heavily involved in the development of the Geographic Information System and has established a comprehensive land tenure and mining tenement database to facilitate the provision of policy advice and to meet public enquiries. The demand for tenement information for real property transactions, alienation of Crown land, and Local Government administration remains high.

ENVIRONMENTAL BRANCH

During the year the Environmental Field Officer, in conjunction with the Tasmanian Chamber of Mines, carried out field investigations of abandoned mining sites to determine rehabilitation requirements.

The Working Group for Mineral Exploration in Conservation Areas, an inter-Departmental Committee chaired by the Senior Geologist-Environmental, now deals with an expanded category of environmentally sensitive areas. The number of field inspections of site

activities was lower this year, reflecting the lower level of exploration activity, and a larger number of surrendered licences were inspected to assess the satisfactory performance or further rehabilitation requirements prior to approval for return of bonds.

COURT OF MINES

Tasmania is divided into four mining districts, each with a Warden of Mines. The Wardens, who are magistrates, hear disputes arising under the Mining Act, 1929. The Wardens are:

- Mr M. A. Hannon, Central Mining District and Southwestern Mining District
- Mr P. T. Dixon, Northwestern and Western Mining District
- Mr A. G. Schott, North and Northeastern Mining District

Cases referred to the Warden during the year consisted of:

Boodarockin Grazing Co. & others v Pioneer Silicon Industries. Objections to Exploration Licence application 19/89. Objections withdrawn.

J. & A. W. Douma & others v Hooker Mining. Objections to Exploration Licence application 16/89. Application withdrawn.

A. Gee v Spectrum Resources. Objections to Exploration Licence application 27/89. Objection withdrawn.

Various Objectors v North West Bay Co. Pty Ltd. Objection to Exploration Licence application 20/89. Objections dismissed.

Smithton Country Club v Mineral Holdings Australia Pty Ltd. Objection to Exploration Licence application 25/89. Objection withdrawn.

D. J. Aylett v Campelane Nominees. Application for forfeiture of lease 19M/72. Forfeiture dismissed.

G. W. Whelan & others v Capricorn Mining Ltd. Objection to Retention Licence 891. Objection dismissed.

Municipality of Huon v S. & G. Armstrong. Application for forfeiture of lease 43M/38. Lease forfeited.

A. J. Cunningham v G. J. Cresswells Transport Pty Ltd. Simultaneous marking out of mining lease applications 51M/89 and 50M/89 respectively. Awaiting decision.

Various Objectors v North West Bay Co. Pty Ltd. Objections to Exploration Licence application 36/89. Objections refused.

Rallinga Mine Pty Ltd v Qintex Ltd. Application for forfeiture of lease 61M/74. Lease forfeited.

Various Objectors v CSR-Readymix. Objections to mining lease application 1414P/M. Objections dismissed.

BMG Resources Limited v G. Archer & others. Ruling sought from Warden on level of compensation to be paid to owners on renewal of lease 595P/M. Hearing listed for December 1990.

Boral Resources Pty Ltd v Tasmanian Hardrock Pty Ltd. Objection to Exploration Licence application 10/90. Objection withdrawn.

ADMINISTRATION BRANCH

GENERAL

The formation of the Department of Resources and Energy, following the Government's restructuring decision, has involved the Division in continuing discussions to identify opportunities for economies of operation in shared resources, both human and material, and/or amalgamation of functions.

Initially, following Mr D. Williams' appointment as Secretary of the new Department, discussion was held with the personnel, accounting and support services managers in the Hydro-Electric Commission but, unfortunately, Mr Williams' tragic death brought this process to a sudden halt. Mr G. Kennedy was appointed Secretary in April 1990 and discussions began along the same lines with the Rivers and Water Supply Commission. This work was continuing at the end of the reporting period.

In addition to the change caused by restructuring, various sections of the Branch have been involved in significant changes to operating systems. These include:-

Records

- Conversion of the current cataloguing system to a Thesaurus/Keyword approach to file definition. This has been a time-consuming task involving the identification and definition of unique organisation-specific terms, and has required close co-operation between records management and system users.
- Identification and evaluation of a new computer-based records management system to replace the system currently running on the TASCIT Sperry mainframe. The main objectives of the change are to achieve economies of operation, a

system more readily adaptable to the Division's needs, and better usage of rapidly changing technology.

Word Processing

- The section has completed the changeover from stand-alone word processing to a centralised system using WordPerfect. The system allows for decentralised word processing stations and, with the addition of laser printers, provides a first class facility for the Division.

Accounts

- A significant change is in progress with conversion of accounting systems to a corporate data base facility using INGRES. During the reporting period a pilot system for processing dangerous goods licences has been installed and tested.

Personnel Services

- The section participated in the planning and development of a new State Service personnel management system aimed at providing an integrated pay and personnel system, and more flexible interrogation and reporting.
- Personnel staff were also involved in a review of technical officer positions in the Division with the intention of rationalisation and proper definition of tasks being performed.

Regardless of the quality and/or quantity of material resources no system will be successful without the support and participation of the people involved. During a time of rapid and far-reaching change everybody has responded to ensure that efficient and effective support services are provided to the Division. The extent of this support is shown by the following indicators:

- Completing the financial year again within authorised expenditure limits.
- Receipt of a satisfactory report on operations from the Auditor-General.
- Meeting all requirements in the provision of word processing services.
- Effecting widespread change in Records whilst maintaining a high standard of daily service.

STAFFING

Divisional staffing at 30 June 1990 was 143, including 12 employed and funded under the Mt Read Volcanics Project. All conditions of employment are set by the State Service Act and Regulations, and Tasmanian Industrial Awards and Agreements.

Eight vacancies were advertised and filled during the year.

The regional distribution of staff is:-

Southern Region	120
Northern Region	18
North West Region	5
	<u>143</u>

STAFF DEVELOPMENT

Seven officers attended management practices courses during the year and a further seven completed courses or workshops in their vocational speciality. Four officers undertook assisted study courses through tertiary institutions.

The Division continued its close association with the general community by giving presentations to industry or school groups on various aspects of the Division's activities.

EQUAL EMPLOYMENT OPPORTUNITY

Equal employment opportunity policies continued to be observed during the year and interview panels were briefed on the application of the merit principle. Every effort is made to ensure that position advertisements are neither gender specific nor framed in terms that are unnecessarily specialised.

INDUSTRIAL RELATIONS

The Division maintained a policy of close association with relevant employee organisations, endeavouring, as far as possible, for union involvement as early as possible in any negotiations. The TSPA's attitude of co-operation is appreciated. A consultative committee, consisting of management and sectional employee representatives, continued to operate during the year and is a useful forum for dissemination of information, and early warning and resolution of potential problems.

Division members also participated in the Agency Consultative Committee set up as part of Government/Union co-operation in State Service restructuring proposals and action.

OCCUPATIONAL HEALTH AND SAFETY

A review of the Rosny Park laboratories was carried out by an inspector from the Department of Employment, Industrial Relations and Training. Action has been taken to correct certain structural problems, and staff are to be further acquainted with the necessity to utilise personal safeguards such as ear muffs.

MINES INSPECTION BRANCH

The Mines Inspection Branch has responsibility for:

- monitoring working environments on mines and works to ensure the health and safety of employees.
- assisting with the processing and monitoring of mining leases.
- provision of an efficient drilling service for the Geological Survey and other Government agencies.

The prime function remained the promotion of safety in the industry and considerable contact was maintained between the inspectorate and our clients — the employees. Monitoring of working environments for atmospheric contaminants continued, and, when necessary, improvements to working conditions were required.

A major breakthrough has been made in the reduction of lost time accidents on mines. Joint efforts by the inspectorate, employees and employers resulted in a 33 per cent reduction in the frequency rate for 1989/90 compared with previous years. Unfortunately one fatal accident was recorded at a smelter.

The Drilling Section had a successful year despite staff shortages and difficult drilling programmes.

STAFFING

Staff shortages of the previous year were overcome by filling vacant positions and at year end the Branch was staffed by five mining engineers, a mechanical engineer and an electrical engineer, two industrial chemists, two technical officers, one drilling superintendent, and eight drilling crew.

Training courses attended by staff included those for:

- legal procedures by the Tasmania Police
- safety training by AMDEL
- management practices by Department of Public Administration

Conferences attended included:

- Chief Inspectors of Mines Conference
- Mechanical Inspectors Conference

MINES INSPECTION SECTION

GENERAL

The Inspection Branch is charged with administration of the Mines Inspection Act 1968 and Regulations. Assistance is supplied to other Branches of the Department and other agencies in administering the following:

- Dangerous Goods Act
- Mining Act
- Petroleum (Submerged Lands) Act
- Environment Protection Act
- Industrial Safety, Health and Welfare Act

Routine and special inspections are carried out to ensure that safe and healthy practices are established and maintained in mines, quarries, works and underground operations of the Hydro-Electric Commission.

During the year 794 field days' inspections were carried out and 120 certificates of competency were issued (Table 5). Approvals were issued for plans and proposals for mining operations where appropriate. Complaints from the public concerning blasting and mining operations were investigated and monitoring was carried out.

Complaints from employees concerning unsafe work practices were investigated and any necessary remedial action was put into place.

To assist in improving relations with officials of the trade union movement, senior union staff attended meetings of the Inspectorate.

REPRESENTATION ON OUTSIDE ORGANISATIONS

The Section was represented on, and fully participated in, meetings of the following organisations:

- Tasmanian Dams Safety Committee
- Industrial Safety Health and Welfare Board
- Chamber of Mines Occupational Health Committee
- Pasminco Metals–EZ Cadmium Committee
- SAA Committee ME/18 Mining Equipment
- SAA Committee EC/33 Mines Electrical Equipment
- SAA Committee MS/H Hazard Zoning

HEALTH AND SAFETY TRAINING AND COMMITTEES

Since the introduction of the Mines Inspection (Employees Safety Representatives) Regulations 1987 allowing the election of employee safety representatives, relations between management, employees and unions on this subject have been through a process of change.

On the major mines and works which have achieved the most success in lost time accident reduction, the emphasis has gone away from elected representatives and 'management' committees towards divisional or mine-wide committees consisting almost entirely of employees. The Tasmanian Trades and Labour Council has had considerable involvement in assisting to establish and train some of the committees.

The Mines Inspection Branch has continued to give lectures on legislation, occupational health, and general safety to representatives and committee members.

Eleven certificates were issued to Employee Safety Representatives.

LEGISLATION

The Mines Inspection Order 1990 was proclaimed on 19 June 1990 which brought the underground tunnelling operations of the Hydro-Electric Commission under the Mines Inspection Act 1968.

This order was considered necessary when it was discovered that the Hydro-Electric Commission Act specifically excluded machinery from the application of the Industrial Safety, Health and Welfare Act to HEC operations. This exclusion caused difficulties in applying normal regulations and controls to the HEC operations inspected by the Mines Inspectorate.

No progress was made with the complete revision of the Mines Inspection Regulations because of other priorities in the office of the Parliamentary Counsel.

PROSECUTIONS

A case against a company and two employees, resulting from a fatal accident in 1987, was again adjourned.

Complaints were laid against four persons following an incident in the Anthony Power Development tunnel when a misfire exploded during drilling operations.

LEASE INSPECTION AND REHABILITATION

Lease applications are inspected to determine the location of the leases and suitable lease conditions. Rehabilitation bonds are assessed in conjunction with the Department of Environment and Planning. Routine inspections follow the success or otherwise of progressive and final rehabilitation.

Rehabilitation continued on major mine sites and on numerous quarries, sand pits and gravel pits. It was necessary to recover bonds from two lease-holders. Work was started on rehabilitation of the Golconda leases at Beaconsfield using the bond, and a rehabilitation prescription was approved for the Oakleigh Creek mine where the bond will also be used during 1990/91.

The Mines Inspectorate successfully encouraged several small lease-holders to clean up their sites and remove rubbish and redundant equipment.



Using an excavator to replace topsoil on roadside verges in the Adamsfield area (above right) and rehabilitation of an old track in the Arthur River area (right)



OCCUPATIONAL HEALTH SURVEYS

Atmospheric sampling and occupational health surveys continued at mines, works and quarries to assess real and potential dangers to employees.

A total of 468 tests were conducted for dust and gas contaminants and 84 tests for noise control were carried out by the industrial chemists and the technical officers. Dust analyses were carried out in the Department's laboratories in Launceston and Rosny Park.

Where testing indicated adverse working conditions, measures taken to increase employee protection included:

- improvements to ventilation
- changes to working practices
- alterations of material handling systems
- requirement to wear approved protective equipment

Because of a proposal by Worksafe Australia that the recommended maximum exposure to amorphous silica fume be reviewed and possibly reduced by a factor of 20, an Amorphous Silica Fume Working Group was established to investigate problems related to this possible reduction. The Working Group consists of representatives from Tasmanian and Western Australian government departments, and from industries manufacturing silicon and ferro-silicon. In addition to preparing a submission to Worksafe Australia, the working group is addressing sampling and analysis of silica fume, medical surveillance and general working conditions.

MECHANICAL AND ELECTRICAL INSPECTIONS

All major mines, works and quarries were inspected by the electrical and mechanical engineers to ensure compliance with the regulations and relevant standards. Considerable general upgrading was carried out to plant and equipment.

Accidents and incidents involving mechanical and electrical equipment were investigated.

Major inspection and approval programmes were required for Pasminco Metals-EZ plant modernisation; Comalco's new potline cranes and carbon baking furnaces; and Mt Lyell underground crusher system and overland conveyor.

Serious incidents requiring the attention of the electrical engineer included an overwind in a shaft and hydrogen explosions at a smelter.

The mechanical engineer was heavily involved in upgrading cranes and vehicles at mines and smelters, and following up training programmes and

certification of crane drivers. Cranes and crane failure investigations were extremely time consuming.

Assistance was given to the Dangerous Goods Inspectorate on matters including fuel tanks and tankers, LPG systems, hazardous zoning, and explosives handling.

SAFETY SEMINAR

In September the Branch organised, in conjunction with the Tasmanian Chamber of Mines, an Occupational Health and Safety Seminar at Launceston. Delegates included employee safety representatives, safety committee members, union representatives, supervisors and safety personnel, and all participated in the workshops.

Topics covered at the seminar included chemical handling, vibration, noise, rehabilitation and building a safety culture. The high percentage of employees as opposed to supervisors attending the seminar was very gratifying and indicated the commitment of all concerned to create a safer working environment.

SAFETY AWARDS

1989-90 was the second year of the Department of Resources and Energy/Chamber of Mines safety competition for mines and works. The competition was introduced to heighten safety awareness and to emphasise the need for a dramatic reduction in the number of lost time injuries sustained by persons in the mining and smelting industries in Tasmania. Although the fatality rate in Tasmania is amongst the lowest in Australia, the lost time injury rate is amongst the highest.

The awards and winners of the competition for 1989-90 were:

- Major achievement in safety for the year, for improvement over previous years, for attention to safety generally, and for special efforts during the year — **Renison Limited**
- Safest small surface operation with 10-25 employees — **Boral Quarry, Launceston**
- Safest large surface operation — **Comalco Limited**
- Safest large underground mine — **Aberfoyle Resources, Hellyer**

Renison Limited's achievement included a reduction of lost time accidents and frequency rate by over 50%, introduction of new training systems, commitment from effective safety committees, and revamping safety procedures in the mill.

All employees of the winning operations are congratulated on their efforts during the year.

ACCIDENT STATISTICS

The 1989-90 accident statistics are listed in Table 4.

The number of lost time injuries and the frequency rates decreased by 33%, and the number of days lost by 30% over the previous year. The frequency rate (number of lost-time injuries per million work hours) at 67 is by far the lowest on record. This is a most pleasing result and indicates that the efforts of management, employees and the inspectorate to improve safety are having a positive effect.

Accidents of one to three days lost accounted for a 37% of total accidents; those of four to ten days a further 38%; and those over ten days 25%.

The number of accidents sustained by persons working underground was 259, or 29% of the total. Underground employees constitute about 10% of the work-force.

One fatal accident was recorded at a smelter.

Fatal Accident

- I. W. Webb of Pasminco Metals-EZ at Risdon received fatal injuries when a scissor-lift platform ran down a steep slope and overturned.

Non-fatal Lost Time Accidents

The following is a brief description of the more serious non-fatal accidents which occurred.

Falls: A boilermaker fell 5 metres when demolishing disused plant; an operator fell through an asbestos cement sheet roof and fractured his leg.

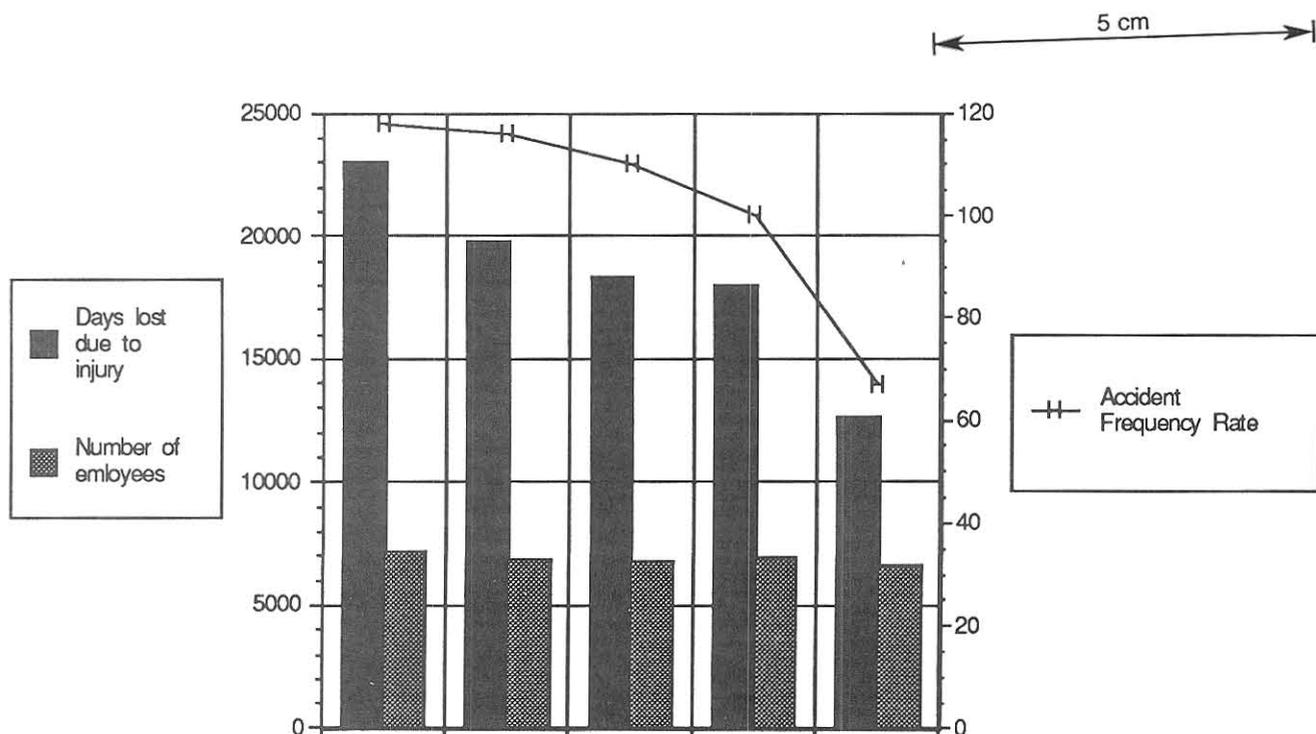
Machinery: A crane chaser was struck by a mobile crane and the load; an operator received cuts and bruises when a grinding wheel disintegrated; a foreman was crushed by a tow-motor; an operator received severe injuries when a high pressure valve ruptured; an operator suffered a fractured arm when caught in a moving conveyor; 15 people were injured when a personnel carrier collided with a ventilation door underground.

Electricity: An operator received a shock when cleaning a furnace tap hole; an apprentice received a shock when crawling along an elevated cable tray; an apprentice received flash burns when a live terminal came into contact with an earth.

Significant Incidents

- Two hydrogen explosions occurred in a newly commissioned solution purification plant at a works. Following investigations, a nitrogen blanket was introduced to the system to prevent explosive mixture accumulations.
- During commissioning of a new winder control intended to improve safety, a skip was accidentally wound into the head-gear at full speed. The electrical problem was rectified.

ACCIDENT STATISTICS — 1985-1990





Fire fighting exercise, Blackwood Colliery

- At an underground mine when a pillar had been charged with bulk explosives, one of the charged holes appeared to detonate or ignite rapidly. No damage or injury occurred and studies carried out by ICI indicated a reaction involving the nitrates in the explosives, ferric sulphate from oxidation of cave material, and sulphides in the drill cuttings.

DRILLING SECTION

Drilling was carried out with four crews. Changes in staff numbers made it difficult to maintain full crews throughout the year. Programme changes and lack of water on Cape Sorell also caused output to be lower than last year.

A major commitment was made to two stratigraphic diamond-drilling programmes on the West Coast. At Miners Ridge near Queenstown, a hole was drilled to a depth of 938 metres into stratigraphic units deeper than any known previously of the Mt Read Volcanics and associated rocks to aid in determining the lower stratigraphic constraints of the ore deposit horizons.

Two holes were drilled to complete a programme started the previous year on Cape Sorell, over Macquarie Harbour.

Faulting of Precambrian rocks thrust over Cambrian rocks was confirmed, and the presence of Tertiary beds below the Precambrian sequence was also revealed in the thrust sequence in each of the four holes.

Other stratigraphic drilling occurred near the Cradle Mountain Link Road, and at Mt Cattley for the Mt Read Volcanics Project, at Lisle in a gold investigation, and at Corinna in a silica flour investigation.

Groundwater drilling comprised the completion of the Sheffield Survey and the commencement of a State-wide survey for monitoring groundwater levels.

Site investigation was carried out for the Department of Roads and Transport at Cooe, Cam River; Hadspen; Victoria River Bridge, Devonport; and at the Grassy Wharf. Other site investigations included a landslip investigation at Hone Road, Glenorchy; Exeter tip; Burnie tip and included a few minor contracts.

Four lost-time accidents were recorded in the section, one of which involved a serious back injury caused whilst lifting equipment.

Summary of drilling, 1989–90

	<i>metres</i>
Stratigraphic drilling	2575.3
Groundwater drilling	941.0
Site investigation	1544.0
Mineral contracts	<u>75.9</u>
Total	5136.2

A full list of drilling programs is provided in Table 19.

CAPE SORELL DRILLING

Two stratigraphic investigation holes were drilled on Cape Sorell, on the West Coast, during the year. The barge *Kulanda* was chartered to transport the equipment from Strahan to Liberty Point, on the western shore of Macquarie Harbour, from where the drill was moved overland.

The programme confirmed a flat fault with Precambrian rocks thrust over Cambrian rocks for the first time in Tasmania. The results have wide significance for the geology of the West Coast.

The photos show the drilling equipment being unloaded from the barge at Liberty Point (top and middle), and being transported overland to one of the drilling sites (bottom).



MINING INDUSTRY — MAJOR OPERATIONS

MINES

Aberfoyle Resources Limited (Hellyer Division)

Operations at Hellyer resulted in 900 000 tonnes of ore with a headgrade of 13.3% Zn, 7.1% Pb and 166 g/t Ag being mined.

The concentrator performance continued to improve during the year to reach an annual ore throughput rate equivalent to one million tonnes. An optimisation programme, entailing an increase in flotation cell capacity, to provide for the treatment of 1.25 million tonnes per annum, was carried out.

Concentrate production for the year ended 30 June 1990 was:

- Zinc concentrate — 74 448 tonnes @ 49.3% Zn, 4.0% Pb
- Bulk concentrate — 46 948 tonnes @ 24.5% Zn, 25.4% Pb, 2.63 g/t Au, 326 g/t Ag
- Lead concentrate — 17 626 tonnes @ 58.0% Pb, 6.4% Zn, 3.11 g/t Au, 656 g/t Ag.
- Copper/Silver concentrate — 2497 tonnes @ 5080 g/t Ag, 8.7 g/t Au, 13.7% Cu.

Surface exploration by mine geologists on the mine lease was concentrated in the area to the north of the orebody. No significant anomalies were detected. A barren Hellyer ore position was intersected with only very weak underlying footwall alteration.

Infill diamond drilling was undertaken over several areas from within the mine and on surface. A total of 14 027 metres was drilled in 110 holes. Approximately 80% of the delineated orebody has been drilled on 20 m × 20 m centres.

During the year the workforce strength was increased from 177 to 239.

Aberfoyle Resources Limited (Que River Division)

A total of 280 000 tonnes of ore was mined from underground sources. Road haulage of ore to the Pasminco concentrator at Rosebery was 290 500 tonnes containing 11.7% Zn, 6.6% Pb, 0.5% Cu, 170 g/t Ag and 2.9 g/t Au.

The total proven and probable ore reserves as at 4 November 1989 were stated as 400 000 tonnes at 10.6% Zn, 5.7% Pb, 0.62% Cu, 139 g/t Ag and 2 g/t Au.

The relatively small tonnage of mineable ore was mainly that *in situ* above 4 level.

By 30 March all recoverable ore below 5 level had been extracted and, as a result, 22 persons were retrenched and hoisting facilities decommissioned. Production from 5 level and above continued, utilising front-end loader and truck haulage via the decline.

By year-end all ore below 4 level had been depleted and the main pumps were relocated on 4 level.

A three-hole programme of deep diamond drilling east of the mine workings was completed. Prospective rock types were recognised and additional geophysical testing was planned.

Beaconsfield Operations Pty Ltd, Beaconsfield

Shaft recovery and pumping continued throughout the year and by 30 June 1990 the water table had been lowered to 154 metres below the collar. The main steel ring beam/bearer set was successfully installed at 99.2 metres, along with the transition from the new steel sets to the old shaft timber sets.

The original shaft timber was in excellent condition and required a minimum of clearing, re-blocking and lagging. New shaft guides were installed at 140 metres and all other services were extended.

Seven pumps were operating at the end of the year with an estimated rate of 310 litres/second. Water was discharged into a new underground pipeline linking with the main open drain south of the Beaconsfield Community Centre. Water treatment and settling dam facilities were upgraded.

Total site expenditure on shaft rehabilitation, pumping, environmental management and general site management was \$1.8 million.

Cornwall Coal Company NL, Fingal

Run-of-mine coal production totalled 574 293 tonnes. The washery produced 359 940 tonnes of saleable coal from the treatment of 596 576 tonnes of raw coal. No time was lost through industrial disputation.

Mining continued in the southern districts of the Duncan Colliery, producing 214 950 tonnes of coal. A small area of coal was developed and extracted at the limit of mineable coal in the south-western district. Development then proceeded in the south-eastern district, the main headings advancing 850 metres. Dykes, seam washouts and generally poor mining conditions were encountered by this development.

At Blackwood, pillar extraction continued throughout the year at No. 1 colliery and had reached No. 25 cut-through at year end, one kilometre from the surface. Development was commenced from the portals at the No. 2 colliery and each of the two main headings was



Blackwood No. 2 Colliery

advanced 120 metres. All the necessary surface facilities for the No. 2 colliery and the belt conveyor were installed. Operations were undertaken in the open cut on an intermittent basis according to demand. Respective coal outputs were 326 275 tonnes from No. 1 colliery, 16 257 tonnes from No. 2 colliery, and 16 811 tonnes from the open cut.

A process change was effected at the washery at mid-year. This gave rise to the plus 16 mm fraction, which had previously been washed in a jig plant and crushed after washing, being pre-crushed, then added to the minus 16 mm fraction and washed in the upgraded dense-medium cyclone plant. Aided by the use in the circuit of an automatic instant ash analyser, higher yield of an improved quality product resulted.

Rehabilitation of disturbed areas continued. Overburden dumps at Blackwood were revegetated with native trees.

Expenditure on capital works amounted to slightly more than \$3 million. The washery (\$1.26 million) and Blackwood No. 2 colliery (\$1.22 million) were the principal cost centres.

King Island Scheelite, King Island

The tonnage of ore produced from underground sources at 132 059 was 7% lower than the previous year but the grade, at 1.23% WO₃, was slightly higher.

Ore milled totalled 128 900 tonnes at a headgrade of 1.215% WO₃. This compares with 151 070 tonnes of ore at 1.136% WO₃ achieved during the previous year.

Gravity scheelite concentrate produced during the year was 890 tonnes containing 65 974 MTU WO₃, while Low Moly scheelite concentrate production totalled 668.5 tonnes containing 53 108 MTU WO₃.

Marketing of concentrates, in particular the gravity concentrate, was again extremely difficult. The situation has been exacerbated by a depressed scheelite price and a relatively strong Australian dollar. As a consequence the mine owners intend to offer the operation for sale.

The labour establishment, at 92 plus 4 full-time contractors, was steady throughout the year.

Merrywood Coal Company, Royal George

Merrywood Coal Company, a division of Avoca Transport Company Pty Ltd, recommenced operations in July 1989. Mining is being undertaken at the Merrywood mine by means of open cutting.

Trial parcels of coal were supplied to a number of users and contracts were secured to supply four customers with a total of 34 000 tonnes of coal over a 12 months period. Coal sales for 1989-90, of both trial and contractual quantities, amounted to 23 200 tonnes.

A new crushing and screening plant, designed to treat 120 tonnes of raw coal per hour, was commissioned in June 1990. Screen sizes are 32 mm on the top deck and 1.5 mm on the bottom deck. The product is a coal of 95 per cent plus 3 mm size.

A total of 12 persons were employed on the mine at year end. No lost time accidents occurred.

Mount Lyell Mining and Railway Co. Ltd, Queenstown

Mine production fell to a level appreciably below that for 1988-89. Ore mined totalled only 1 332 930 tonnes. The grade dropped to 1.28 per cent Cu.

Production started from the 50 Series of stopes, but not until several months after the date scheduled. The delay caused the tonnage shortfall and, because overdriving was resorted to in earlier mined areas, the drop in grade.

Development of the 50 Series continued throughout the year. The 60 Series decline was commenced and advanced 150 metres. Stripping was undertaken of the 10 metre level to 90 sub level section of the Southern Exhaust Airway and was nearly complete at year end.

The 18 level crusher station was commissioned early in the year, together with the overland conveyor between the shaft and the concentrator. Full scale hoisting at the Prince Lyell No. 1 shaft commenced towards the end of July 1989, and subsequently 407 462 tonnes of ore and 41 495 tonnes of waste were hoisted.

Operations at the concentrator proceeded without event. Concentrator production amounted to 59 206 dry tonnes of copper concentrate and 71 221 dry tonnes of pyrite concentrate. The copper concentrate contained 15 712 tonnes of copper, 360 170 grams of gold, and 2 020 625 grams of silver.

Capital expenditure totalled \$5.52 million. Slightly more than \$3 million were expended on the overland conveyor and underground crusher. Major equipment purchases comprised a new scooptram and a new grader.



Stripping overburden, Merrywood Colliery open cut.

For reasons of economy, the workforce was reduced approximately 15 per cent in the last quarter of the year, and some restructuring was undertaken. This included continuous roster working being reintroduced in the concentrator and concentrate haulage being transferred from the company to contractor.

There was significant improvement in the safety performance. Only one incident involving serious injury occurred during the year.

Pasminco Mining – Rosebery

Ore production from Rosebery underground sources amounted to 482 876 tonnes at 10.4% Zn, 2.9% Pb, 0.6% Cu, 89.5 g/t Ag and 2.3 g/t Au. This reflected a shortfall of 13% against the planned tonnage for the year. The shortfall was attributed to a delayed start in mechanised cut and fill stoping at the north-end of the mine, and to geological structure weaknesses in certain bulk stopes.

Hoisting problems were overcome to a large extent with the installation and successful commissioning of a rock sizer located over a shaft orepass.

Increased treatment plant availability was achieved through improved maintenance. A total of 782 273 tonnes of ore was milled from the following sources:

- Rosebery Mine — 489 617 tonnes
- Que River Mine — 289 260 tonnes
- Small Mines — 3396 tonnes

Concentrate production was:

- Zinc concentrate — 136 469 tonnes @ 53.4% Zn
- Lead concentrate — 23 233 tonnes @ 61.3% Pb, 690 g/t Ag
- Copper concentrate — 26 709 tonnes @ 11.8% Cu, 33.4% Pb, 1674 g/t Ag, 37.5 g/t Au

Recovery of all metals was marginally less than for 1988–89 due to generally lower headgrades and difficult ore types with high iron content.

Considerable improvement was made in the plant in the way of housekeeping by the removal of redundant equipment, thus providing better access to installations. Lifting gear was installed to facilitate the handling of heavy items of equipment in areas where access is difficult.

Twelve 8 m³ flotation cells were installed and commissioned to replace old rougher and scavenger cells, reportedly increasing the metal recovery rate.

By year-end an investigation into the upgrading of the copper concentrate had reached an advanced state.

Ore reserves were redefined using a geostatistical method of estimating ore reserves. Geological resources reflected a slight increase over those indicated the previous year.

Renison Limited, Renison Bell

Mine production amounted to 753 786 tonnes of ore at a grade of 1.34% Sn. The concentrator treated 741 569 tonnes of ore and produced 7831 tonnes of tin in saleable concentrate. Mill recovery, at 78.5%, and tin production were once again all time records for Renison.

The grade of ore mined again improved, predominantly as a result of tighter geological and grade controls being exercised. Dilution was further reduced by cleaner mining. Record metal recoveries in the concentrator processes were another principal reason for the record tin output.

A further six concentrator evacuations occurred as a consequence of hydrogen sulphide or carbon disulphide emissions. Most occurred during routine or breakdown maintenance periods. All were manually activated on sub-TLV concentrations.

In conjunction with Amdelcare, industrial hygiene consultants, Renison has formulated a new occupational health programme. All aspects of this programme are now active. A full-time industrial hygienist is employed overseeing implementation.

Capital expenditure over the year totalled \$5.42 million. Underground mobile equipment, chiefly in the form of three new haul trucks, a new rock-drilling jumbo and a new grader, accounted for half of this amount. Significant sums were also spent on raising the tailings dam, upgrading the 1700 pumping facility, and purchasing and installing a surface fan for the 13 Rise system (upper mine extension).

Environmental work was concentrated on restoration of the old Battery Mill site alongside the Argent River. At year end, this site had been cleared and its re-vegetation had commenced.

Industrial relations and safety performance were at their best levels for many years. Only three days were lost in the mine through industrial dispute. Safety performance improved dramatically. Late in the year, 93 days passed without a single lost-time accident occurring anywhere in the operations.

An appreciable drop in tin price early in the year caused Renison to adopt cost-cutting measures. In April 1990, the labour strength was reduced by some 50 persons and the remaining workforce was restructured, with the aim of encouraging efficiency improvement.

RGC (Tas.) Ltd and Little River Resources Pty Ltd — Henty Project

The development designed to prospect a mineralised zone on the leases was completed in October 1989. During the year, 294 metres of declining, 47 metres of crosscutting and 212 metres of driving within the auriferous mineralised zone were achieved.

During the course of the sill development in the mineralised zone the face of each heading was sampled after each blast. Bulk samples were accumulated from the broken rock for metallurgical testing.

In addition to the development in mineralisation to explore the zone, diamond drilling from the surface and from underground sites was carried out.

Drilling achievements for the year were:

Surface drilling	8481 metres
Underground drilling	2811 metres

Work began on the drafting of an Environmental Management Plan for a possible underground gold mine.

During the period when development of the sill was being carried out, 40 persons — 28 of whom were contracted development and diamond-drilling personnel — were involved in the operations.

Savage River Mines

The two-year wind down of the operation, commenced on 1 October 1988, was continued throughout the year.

All material movement was down 25% on that of the previous year, reflecting a decrease of about 43% when compared with the achievement for the year ended June 1988.

The tonnage of crude iron-ore mined during the year exceeded that of waste dumped, and was only 3% lower than that for the previous year. Concentrate and pellet production tonnages, at 2.31 and 2.26 million tonnes respectively, were very similar to those of the 1988–89 year.

The labour force was reduced from 512 to 486 in line with the wind-down procedure.

Negotiations regarding the continuation of operations beyond September 1990, at an annual production rate of approximately 1.3 million tonnes of pellets/concentrate, were well advanced at year-end.

A major toppling failure in the western wall at the northern end of the Central Deposit open cut disrupted production from this major source of ore. A new open cut was developed in the South Lens as an interim replacement source while slope rehabilitation work was being carried out in the Central open cut. By

year-end the South Lens open cut had been developed down to the 6th lift.

No exploration work was undertaken on the mine leases during the year.

Spectrum Resources, Lottah

Production from underground at the old open cut Anchor mine continued. Ore mined totalled 43 000 tonnes at an average headgrade of 0.44% Sn, and concentrates containing some 132 tonnes of tin were produced.

The concentrator was commissioned in July 1989 but required considerable modifications during the year.

Capital expenditure was \$1.1 million.

Tasmania Mines, Kara

A total of 208 000 tonnes of ore was mined, consisting of 100 000 tonnes of millfeed scheelite ore, 53 000 tonnes of marginal stockpile ore, and 55 000 tonnes of waste.

Ore treated during the year was 109 759 tonnes at an average headgrade of 0.52% WO_3 .

Concentrates produced were:

High grade scheelite concentrate — 221.85 tonnes @ 74.67% WO_3

Low grade scheelite concentrate — 441.89 tonnes @ 43.60% WO_3

Magnetite concentrate — 75 353 tonnes @ 64% Fe

Prospective future sales of magnetite are most encouraging and the stockpile of magnetite tailings discarded by the old Kara milling operation were being systematically drilled, sampled and assessed at year-end. Sections of this stockpile were retreated during the last four periods of the year under review.

Special attention was given to the evaluation of magnetite reserves at the Hampshire Magnetite Skarn Deposit and Kara No. 2 South deposit.

A haul road was established along the eastern limit of the Kara No. 1 open cut, providing access to each 15 metre lift and to the Eastern Ridge tungsten deposit.

Plans for the development of small-scale open-cut operations at the Eastern Ridge and the Kara South deposits were approved, and development of the Eastern Ridge deposit commenced.

As from mid-March the ore processing operation was reduced from a two-shift operation, employing 22 persons full-time and 1 part-time, to a single-shift operation employing 12 persons.

WORKS

Comalco Aluminium (Bell Bay) Ltd, Bell Bay

Production was 123 000 tonnes of aluminium in the form of blocks, ingots, bars, billets and granules, from 233 000 tonnes of alumina. Main areas of activity at the works are manufacturing of carbon products, smelting of alumina, metal alloying and casting.

Raw materials used include alumina from Gladstone in Queensland, and coke, oil and aluminium fluoride from interstate and overseas. Some 240 megawatts of power from the State grid are used on a continuous basis.

A major event during the year was the commissioning of the new Anode Baking Furnace which cost a total of \$70 million.

Capital expenditure for the year was \$28 million.

Goliath Portland Cement Co. Ltd, Railton

In September 1989, ownership of the company was transferred to CSR-Pioneer International and a major expansion was proposed. It is estimated that capital expenditure on the uprating of plant will exceed \$75 million but at year-end the project had not received final approval.

During the year 479 826 tonnes of cement and 400 tonnes of 'Plastaid' were produced. 745 518 tonnes of limestone and 36 937 tonnes of clay were mined from the quarry adjacent to the works.

The new 80 000 tonne clinker storage and blending plant was filled to capacity for the first time in May 1990.

Research into the plant performance continued during the year.

The asbestos-cement factory machinery was completely dismantled for conversion of the factory into workshops.

M.K. Silica, Heybridge

A total of 19 300 tonnes of high grade silica flour was mined from two deposits near Corinna and road hauled to the plant at Heybridge.

The recovery rate from the Heybridge beneficiation plant process of a coarse silica flour product improved from 50% to 60% due to a change in the nature of the raw material and to plant improvements, and 10 300 tonnes of this material were recovered. During May a pilot plant was installed to dry fine material for market trials. Previously the fine material had been discarded as waste.

Capital was spent in the replacement of the mill feed system and open conveyors, and in the fines drying plant. At year-end, the installation of additional DSM

screens was in progress. Major improvements in dust emission levels and waste disposal methods were achieved during the year.

Five permanent and up to seven casual employees were engaged in the beneficiation plant.

Pasminco Metals-EZ, Risdon

Production of zinc and alloys totalled 178 000 tonnes from sulphide concentrates from Rosebery in Tasmania and Elura and Broken Hill in New South Wales.

The main by-products of the works are cadmium metal, cobalt oxide and sulphuric acid. The acid is used in the production of superphosphate from phosphate rock. Approximately 110 megawatts of electricity are used on a continuous basis from the State grid.

Both major and minor plant improvements, as part of the \$150 million modernisation program, continued to be commissioned during the year.

The Solution Purification Plant was commissioned early in the year, but following hydrogen explosions a shutdown was required whilst a nitrogen blanketing system was installed. No persons were injured in the explosions.

Asbestos removals continued and all major plant which was clad with asbestos thermal insulation has had the asbestos removed.

The safety drive of the past few years showed success, with an improvement in employee relations and a dramatic reduction in the number of lost-time accidents.

Pioneer Silicon Industries, Electrona

Lump silica from leases throughout Tasmania is treated in the 14 megawatt reducing-arc electric furnace to produce silicon metal for the aluminium and chemical industries. Production of crushed, graded and screened metal was some 9700 tonnes from 20 000 tonnes of raw silica.

Following sampling of the workplace atmospheres for contaminants, particularly amorphous silica and nuisance dust, the ventilation provisions of the furnace were reviewed and upgraded. Further sampling showed improvement to the working environments.

Tasmanian Electro-Metallurgical Company, Bell Bay

Temco is the only ferro-alloy plant in Australia, and satisfies most of Australia's demand whilst still exporting 50% of production. Manganese ore from Groote Eylandt is treated with iron and quartz from South Australia and coal from New South Wales to produce ferro manganese, silico manganese, ferro silicon and sinter in four furnaces.

High grade silica from several Tasmanian quartzite deposits is being tested to find a replacement for imported materials.

Capital expenditure for the year was \$8.3 million.

Tioxide Australia Pty Ltd, Heybridge

The plant continued to produce titanium dioxide pigment by the sulphate process from ilmenite imported from Western Australia. Plant expansion and modernisation programmes continued, with a capital expenditure of \$11.5 million.

DANGEROUS GOODS INSPECTORATE

INTRODUCTION

The primary objective of the Dangerous Goods Inspectorate is to provide Tasmania with a credible inspectorate for the enforcement of the Dangerous Goods Act 1976 and Regulations. The preparation of the Dangerous Goods Regulations 1990 during 1989–90 permitted the legislative principles embodied in the various international and national conventions, codes and regulatory systems pertaining to dangerous goods to be implemented in the interest of uniform State and Territory legislation.

A factor which emerged during the 1980s has been environmentalism. Such is the ground swell of public opinion underpinning the environmental movement that many issues which previously hindered the harmonisation of dangerous goods legislation have been resolved. Despite the legislative advances achieved, the State has not been without its share of dangerous goods accidents. The ability for dangerous goods to wreak havoc unites everyone associated with such incidents, and a good working relationship exists between the Inspectorate and other State Agencies. Hence, Tasmania is provided with a viable response to incidents.

The Tasmanian Dangerous Goods Regulations are based on and harmonise with the United Nations system, which ensures that no single sector of industry is unfairly disadvantaged due to its geographical location. Unfortunately when a major incident occurs, one of the first things which seems to be forgotten in those heated and emotional moments immediately after, is the excellent system of dangerous goods regulations that has been developed by dedicated men and women over the past thirty years. In the vortex following a crisis, the Inspectorate's response is often hindered by having to divert scarce resources to deal with the cries for new legislative controls which fill the air from various factions that pay scant attention to the highly developed system already in place.

In a modern industrialised society the main problem facing the Inspectorate is the public's perception of the risk associated with dangerous goods. Unfortunately, the person in the street regards the manufacture, handling, packaging, storage and transport of dangerous goods as being much less safe than is actually the case. The growing threat from this premise is that fear could be translated into unnecessarily onerous legislation which, at the end of the day, does not do anyone any good and actually jeopardises safety. The Inspectorate is confident that the new Dangerous Goods Regulations 1990, together with increased activity in the educational field will help to address the above problems.

DANGEROUS GOODS ACT 1976

There were no amendments or additions to the Dangerous Goods Act, 1976 during the year. The Dangerous Goods (Fees) Regulations 1990 were gazetted on 20 June 1990 and commenced on 1 July 1990. The Dangerous Goods Regulations 1990 were gazetted on 29 August 1990 and commenced on 30 August 1990. Amendments to the Dangerous Goods Regulations in order to implement the ALP fireworks policy is progressing and will be in place for the 1991 season.

The Dangerous Goods Act 1976 and Regulations 1990 are in place to ensure the safe manufacture, handling, packaging, storage, transport, and import of all classes of dangerous goods, except class 7 radioactive materials. The regulations under Section 19 of the Act adopt the principles of classification and definition of classes as specified in the International Maritime Dangerous Goods Code (IMDG), including the dangerous goods listed in the General Index of that code, which also outlines the general packing requirements, testing procedures, marking, labelling or placarding the shipping documentation.

The Regulations, in the interest of international and national harmonisation, also adopt under Section 19 of the Act (in addition to the IMDG Code) the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG); the Australian Liquid Petroleum Gas Association (ALPGA) Code; the Australian Gas Association (AGA) Code; and approximately fifty Standards Association of Australia (SAA) Codes dealing with the manufacture, handling and storage of dangerous goods.

Over the past decade, on an international and national scale, there has been a proliferation of regulations. Their enforcement and the need for compliance dictates the need for higher staffing levels and larger budgets. However within the general climate of financial constraint, which applies nationally as well as on a State basis, budgets are being 'axed' rather than strengthened. This policy creates problems for the Inspectorate and ultimately poses the philosophical question; should safety standards be mandatory or voluntary?

The Inspectorate over the past year has actively supported, in principle, the Australian Chemical Industry Council (ACIC) Responsible Care Program and actively supported the Agricultural and Veterinary Chemicals Association of Australia Ltd (AVCA) Industry Standard Project. However the Inspectorate is committed to the mandatory approach but attempts to adopt a balanced view in that voluntary standards or self regulation do not mean one thing and mandatory standards and regulations another. There is no doubt that having to comply with mandatory standards and

regulations results in more appropriate voluntary standards and self regulatory schemes implemented by industry.

The role or emphasis of the Inspectorate is gradually changing, from being a purely enforcement agency to one which can provide industry with advice and consultancy in all matters pertaining to dangerous goods. This dynamic approach will undoubtedly provide Government with a credible role in industry while keeping a hand on the pulse. Through this process the Inspectorate becomes aware of problems associated with regulatory requirements, and can positively influence the drafting of international and national legislation in the manufacture, handling, packaging, storage and transport of dangerous goods through membership of the following working committees:-

- Australian Conference of Chief Inspectors of Explosives.
- Australian Committee on the Transport of Dangerous Goods; Working Group on the Transport of Explosives.
- Australian Committee on the Transport of Dangerous Goods; Drafting Sub-Committee.
- Advisory Committee on the Transport of Dangerous Goods; Competent Authorities Sub-Committee.
- Standards Association of Australia; CE/5 Committee on Explosives.
- Standards Association of Australia; CH/9 Committee on Chemicals.
- Standards Association of Australia; ME/15 Working Committee on LP Gas.
- Standards Association of Australia; ME/17 Working Committee on Flammable and Combustible Liquids.
- Australian Liquid Petroleum Gas Association; Working Committee.
- Tasmanian Hazardous Substances Management Committee and Associated Working Groups.
- Southern Regional Disaster Planning Group.
- State Pesticides Working Party.

EDUCATIONAL SERVICE TO INDUSTRY

The Inspectorate has been instrumental in developing, organising and actively participating in the following educational and training schemes:-

- The Tasmanian Road Transport Industry Training Council course for drivers of dangerous goods vehicles.

- Shotfirers course and examinations in accordance with the requirements of the Dangerous Goods Regulations 1990.
- Agricultural and Veterinary Chemicals Association of Australia training courses in Tasmania in conjunction with Tasmania Adult and Further Education (TAFE) programmes.

The Inspectorate is represented on The Chartered Institute of Transport, Education Sub-Committee providing an advisory role in transport educational programmes, and active participation in seminar programmes organised or supported by the Institute.

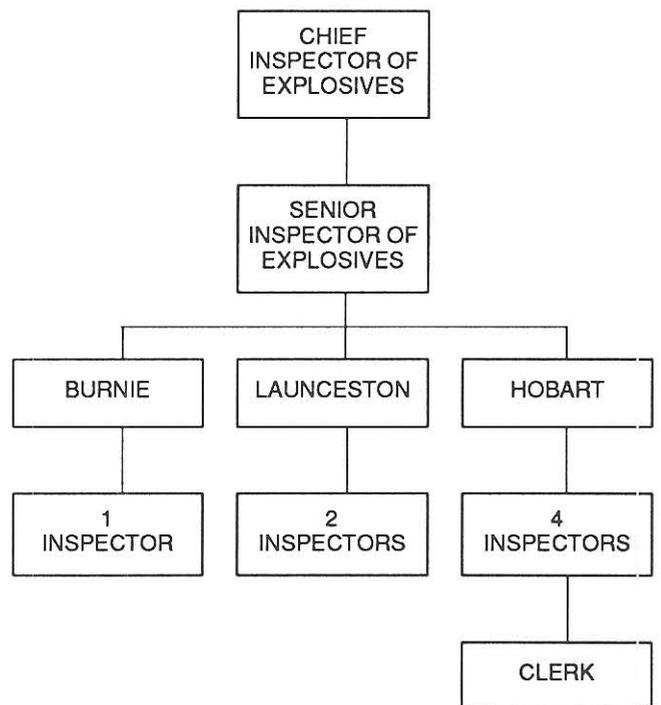
The Inspectorate acts on requests from any industrial body or individual company to provide talks or seminars related to their particular interest in relation to dangerous goods safety.

STAFF

The Inspectorate is now at full strength with a staff of ten, and an extensive training programme has been implemented for newly-recruited inspectors in conjunction with existing staff training programmes.

During the year the position of dangerous goods clerk has been formally filled, and the role of magazine clerk/keeper for the Dilston magazine has been admirably accomplished by the Launceston administration clerk.

Dangerous Goods Inspectorate Organisation Chart



ACTIVITIES

All imports in bulk of Class 1, 2.1, 3.1, and 3.2 dangerous goods through the ports of Burnie, Devonport, Hobart

and Launceston were supervised by Inspectors. Statistical details are contained in Tables 15 and 16.

The number of field inspections carried out by the Inspectorate covering import, export, storage and handling, use and sale have remained more or less static at 2884 (2963 in 1988–89) because of staff recruitment and training earlier in the year. The statistical records of licences, permits and approvals issued for the import, manufacture, storage, use and sale of dangerous goods are contained in Table 14.

The explosives magazine at Dilston has had a busy year, handling 8341 issues and 8288 deposits, representing a total throughput of 16 629 cases (14 877 in 1988–89). Details of explosives imported into the State during the year are contained in Table 16.

Enquires and appeals for assistance in the disposal or destruction of dangerous goods of all classes continue to increase. Consequently the Inspectorate has no alternative but to concentrate on meeting its obligations under the provisions of the Act.

Requests for assistance on the disposal of any hazardous material which cannot be properly disposed of at the premises at which they are kept are referred to the Department of the Environment and Planning. However the Inspectorate will continue to assist and advise on the co-ordination, packaging and storage of hazardous material within the jurisdictions of the source of origin prior to disposal. The Inspectorate has no mandate to deal with the ultimate disposal, destruction or clean up of hazardous waste.

FIREWORK SEASON

The strategy of the Inspectorate for the 1990 season was towards a co-ordinated approach for the import and testing of fireworks, and the education of the public on the safe handling of fireworks. There were 283 licences issued for the sale of fireworks and 17 firework landing permits granted.

The safety campaign, mounted in conjunction with the media during the fireworks season, centred on the Department's video "Fun with Fireworks". Inspectors were interviewed on TVT Channel 6 News, Radio 7HT and 7ZR, and articles on the safe handling of fireworks were published in *The Mercury*, *Southern Star*, *The Examiner* and *The Advocate*.

The Department of Health Services reported five injuries requiring hospital treatment. The Tasmania Police received 629 complaints, representing a 35% increase on the previous year. There were eighteen prosecutions launched and eighteen persons were charged with offences, mostly relating to the misuse of fireworks in a public place.

The Tasmania Police also expressed serious concern at the increased number of homemade firework launching devices recovered from young persons.

These devices had been used to direct fireworks at motor vehicles and houses.

The Tasmania Fire Service attended fifteen fires attributed to fireworks, mostly grass fires started by either exploding fireworks or bonfires out of control, with minimal damage to property.

The enforcement of fireworks legislation is particularly difficult, as the current State legislation permits their widespread private use. The ALP policy on fireworks is supported by the agencies mentioned above and reflects the ground swell of public opinion which wishes to see the use of fireworks restricted to organised community displays aimed at eliminating their misuse in public places.

The necessary legislative changes will be in place for the 1991 fireworks season.

INCIDENTS

There were forty-six incidents involving dangerous goods investigated, two more than last year. To provide an insight into the depth and breadth of the Inspectorate's activities in this field, an incident from each dangerous goods class is summarised below.

Class 1.D Explosives

Most incidents concerning explosives are related to theft or discovery by chance of discarded explosives. An incident occurred in the Devonport area when youths from a local school discovered by chance water-in-oil based emulsion explosives stored in an unsecured shed at a local quarry. The explosives had been left over from a blasting operation because of a breakdown in communications by the persons concerned.

The youths removed the explosives from the shed, and the subsequent theft and illegal use became a matter of a Tasmania Police investigation. On being informed of the incident by the Tasmania Police the Inspectorate visited the quarry and confiscated the remaining explosives and commenced investigations into the conduct of the quarry owner and shotfirer responsible for the blasting operation.

Water-in-oil based emulsion explosives are reasonably stable, have a very low impact sensitivity, and will not ignite easily. Therefore, unlike sensitive nitroglycerine based explosives, the water-in-oil based emulsion explosives were capable of withstanding the insensitive handling meted out by the youths. The youths removed the wrapping from the explosives and stuck pieces of the plasticine-like material on various locations around their school buildings. Fortunately, the makeshift attempts to detonate the explosives failed, reinforcing the safety margins inherent in the product. The school was closed while Tasmania Police removed the remains of the stolen explosives.

Class 2.1 Flammable Gases

A number of incidents occurred during the year involving LPG when safety procedures were ignored. In one particular incident the gas fitter, working under duress to meet deadlines for an official opening, failed to conduct purging procedures in accordance with practice.

On installing a gas stove the gas fitter, after a series of attempts to purge the supply line, attempted to ignite the stove at the top level. Unfortunately the gas from previous purging attempts, which had accumulated at floor level within the room, had reached the lower explosive limit, and a violent explosion occurred which resulted in five people being hospitalised.

A common theme in all LPG incidents investigated during the year was one of human error, compounded by a failure to follow laid-down safety procedures.

Class 3.1 Flammable Liquids

A road tanker driver delivering petrol to a rural property was admitted to hospital for burns after the dispensing hose nozzle contacted an electric fence near the on-ground tank being filled. Despite suffering from severe burns to the hands and arms, the driver's quick action in extinguishing the fire, which completely destroyed the hose, prevented a major escalation of the incident.

The incident illustrates that when handling petroleum one must be a thinking person; it cannot be done by numbers and there is no room for complacency.

Class 4.3 Substances Emitting Flammable Gases when Wet

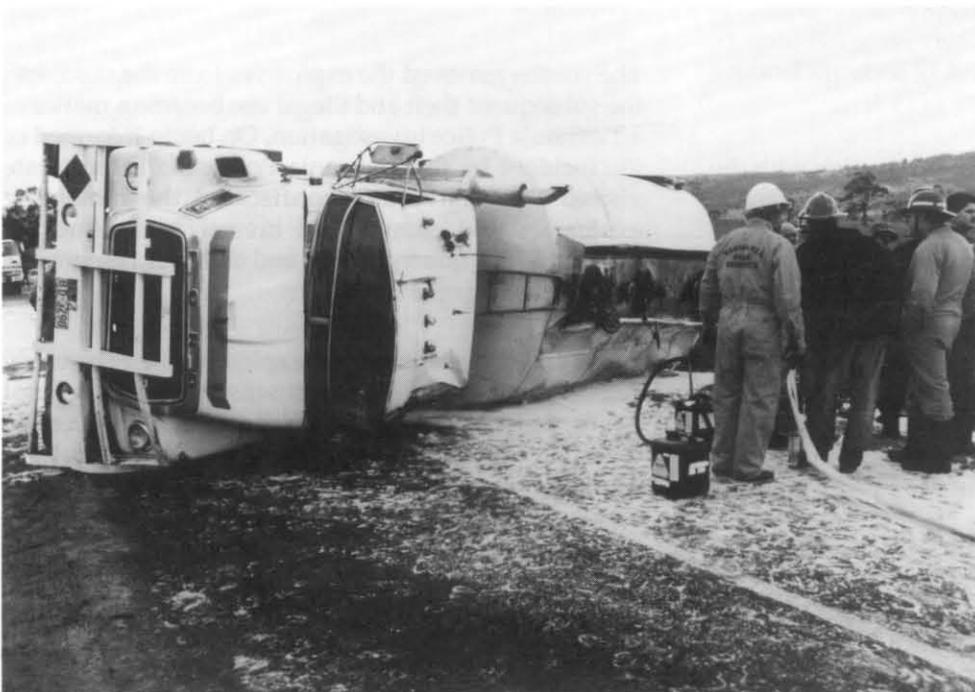
In this incident the new owner of an industrial site was given erroneous advice by the local council on how to deal with eight drums of calcium carbide left behind by the previous owners. The advice received set the scene for a potentially dangerous incident. Fortunately, before being able to implement the advice given, heavy rain fell reacting with the calcium carbide to produce acetylene gas and calcium hydroxide.

The Inspectorate was alerted by the Tasmania Fire Service at the scene of the incident, and subsequently attended to provide advice and supervise the disposal of the calcium carbide under controlled conditions.

Class 5.1 Sub-Class 8 Oxidising Agents/Corrosives

Perhaps the most vulnerable operations in relation to dangerous goods are handling and transport. In this incident a 200 litre drum of hydrogen peroxide fell off a delivery truck at a roundabout within an industrial compound. All the spill content was contained within the pine bark used for landscaping purposes on the roundabout. Spontaneous combustion caused a small fire which was quickly extinguished by fire-fighters belonging to the company in whose premises the incident occurred.

Because of the potentially serious nature of the incident, which fortunately did not occur on a public road or place, the Inspectorate investigated the matter. The hauliers and associated trade unions were interviewed concerning the incident, and as a result the Inspectorate provided advice on the correct handling of the product including the requirements for transport vehicles.



A fully laden road tanker overturned at a railway crossing west of Avoca in July 1989, spilling motor spirit and diesel onto the road and adjacent farmland. The Esk Highway was closed for six hours.

The manufacturers have since provided the Inspectorate with videos and product literature for use at training seminars.

Class 6.1 Harmful Substances

The initial impact of some incidents can cause great consternation. If the media become involved they tend to milk every ounce of emotion they can out of it, absent-mindedly forgetting the facts on the way. Fortunately an incident involving a freight container, containing 2.4-D Phenoxy Iso Butyl Ester escaped media attention, allowing the matter to be resolved expeditiously.

The incident commenced with waterfront workers claiming that a smell emanated from a freight container which contained 2.4-D Phenoxy Iso Butyl Ester. Although in transit, the Inspectorate had the freight container landed for inspection. No leakage was found and the intermediate packaging was found to be in good condition.

The Inspector attending the incident obtained a sample of a like Iso Octyl Ester. As this group of compounds are "carbolic sweet", the waterfront workers agreed that this did not relate to the "pungent" smell detected when the ship's hatches were first opened. The freight container was declared clean and put on board the vessel to continue its voyage to a Far Eastern destination.

Although the incident turned out to be a false alarm, with the loss of many man hours, all due precautions had to be undertaken until experts at the scene declared the situation safe.

Class 8 Corrosives

The Inspectorate are involved in diverse activities when dealing with dangerous goods, and two incidents involving Class 8 products provide a good example of this diversity. One incident concerned the storage of concentrated detergents in the form of dairy cleansers, and the other a major spill of sulphuric acid after a derailment.

Both incidents were dealt with in an efficient and satisfactory manner and the Inspector attending the latter incident received a letter of appreciation from the railway company.

CONCLUSION

The above compendium of incidents not only illustrates the diversity in the activities of the Dangerous Goods Inspectorate but also demonstrates that it is competent to regulate the manufacture, keeping, conveyance, use and sale of explosives, flammable liquids and other



Eight wagons, including four tank wagons containing sulphuric acid, derailed as a Hobart-Burnie freight train passed under the Midland Highway overpass south of Conara. One of the tank wagons ruptured in the derailment, spilling approximately 20 000 litres of acid into trackside drains.

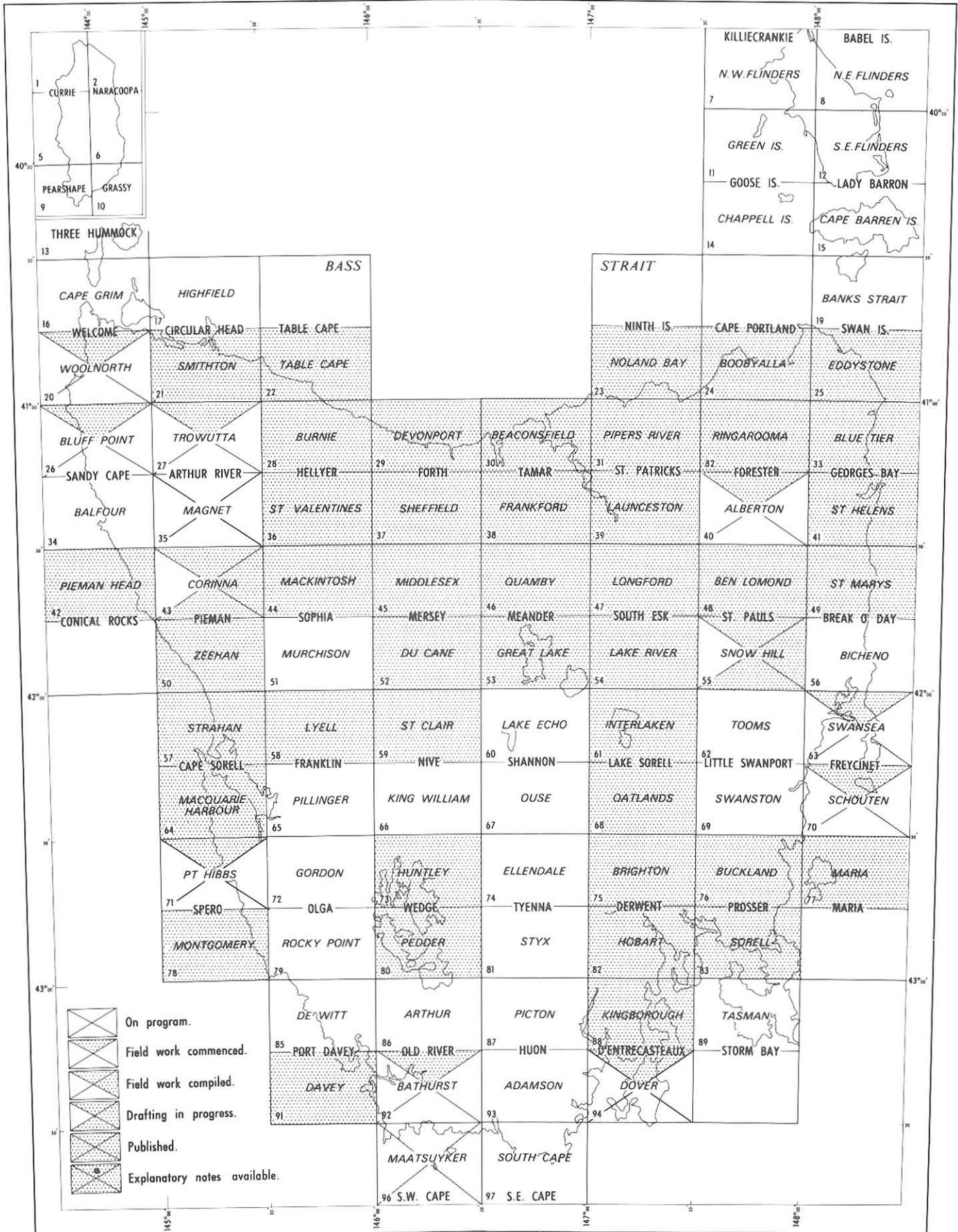
dangerous goods and matters incidental thereto in accordance with the Dangerous Goods Act.

However the main control of the Inspectorate is through preventive inspections, in which premises are visited unannounced. Such visits not only serve to remind industry of the agency's presence but also provide the opportunity for advice and guidance to be given before problems arise which finally culminate in an incident of one form or another.

Enforcement has many facets which must be exercised to ensure a viable control regime. Legal action is only a last resort but the Inspectorate must leave industry in no doubt that they are prepared to take it, as no company should be allowed to think that it can achieve commercial advantage by ignoring regulations. All effort expended in the development of regulations count for nothing unless they are seen to be effectively enforced by a viable Inspectorate.

GEOLOGICAL ATLAS MAPPING PROGRAMME

1:50 000 and 1:63 360 scales



5 cm

GEOLOGICAL SURVEY BRANCH

REGIONAL GEOLOGICAL MAPPING

This section, which consists of 10 professional officers, produces systematic, multipurpose 1:50 000 scale maps of the Geological Atlas Series with corresponding explanatory notes. Each map is compiled from a long-term programme of field and laboratory work, with field investigations in western and southwestern Tasmania carried out during the summer months, and the remainder of the State during the rest of the year.

Usually the variation in the geology of most map sheets is so considerable that the geologists work in teams to cover all the specialities (stratigraphy, structure, petrology etc.) required to adequately investigate the geology.

The work done on a 1:50 000 scale map extends over a number of years, but the results of component investigations can be made available as they come to hand and can be grouped according to any particular interest of society (mineral exploration, forestry, groundwater, etc.).

MAPPING

The interests of various sectors of society in the 1:50 000 series map quadrangles which were mapped during 1989–90 are listed below.

Woolnorth Map Project

Mapping of this sheet has been completed and compiled for publication. The Woolnorth Quadrangle covers the region west of Smithton in northwestern Tasmania. The sheet extends over an area of the Eocambrian–Cambrian Smithton Basin, which is a faulted upright synclorium resting unconformably on a Precambrian basement of orthoquartzite and strongly-cleaved laminated siltstone. The basin consists of units of chert, basalt, clastic sedimentary rocks, dolomite and dolomitic limestone. Flat-lying Tertiary shallow-water marine limestone occurs with basaltic volcanic rocks of marine association. Substantial areas are covered by Quaternary deposits, particularly those areas underlain by dolomite and limestone of the Smithton Basin.

Older units of the Smithton Basin have attracted mineral exploration for base metals, and the distribution of these units is now accurately defined and their three-dimensional configuration determined.

Correlations can be made between flora, soil types and underlying rock units. The tallest stands of eucalypt forest are usually supported by clay-rich soils developed on low ranges of hills underlain by sedimentary rocks and basalt of the Smithton Basin. Soils derived from Tertiary basalt are the best for agriculture whereas cleared and drained regions

underlain by Quaternary sand deposits form good grazing land.

Dover Map Project

The nearly completed Dover map sheet includes South Bruny Island and, in the west, a part of mainland Tasmania. The region is underlain by flat-lying Late Carboniferous to Triassic sedimentary rocks of the Parmeener Supergroup which have been intruded by thick sheets of Jurassic dolerite. Remnants of a once thick Tertiary cover are occasionally preserved, and Quaternary deposits of talus and coastal-derived sand sheets are common.

Parmeener Supergroup coal measures have been stratigraphically delimited and occur at two separate stratigraphic horizons rather than the one previously assumed. Mapping has resulted in greater accuracy in predicting three-dimensional distributions of underlying rocks in geophysical investigations required in current petroleum exploration.

Farmland can be developed on the suitable soil types of usually non-dolerite areas. Any future additional water supplied will be from underground resources, the location of which can be determined with greater accuracy.

Alberton Map Project

Some 40% of this sheet, which is in northeastern Tasmania, has been mapped. A northerly-trending belt of folded Early Devonian Mathinna beds occupies the central part of the region. The Mathinna beds, which are host to gold-bearing quartz veins, have been intruded and metamorphosed by Devonian granites. Flat-lying Permian Parmeener Supergroup sequences rest unconformably on the older rocks in the central area of the map sheet.

Investigations are underway to assess which granite types are most likely associated with Sn/W mineralisation, and detailed structural analyses of the intruded Mathinna beds are revealing the large-scale deformations which may control the distribution and development of the gold-bearing quartz veins of the region.

There are widespread forestry operations in the region, and the relationships between types of flora, soils and underlying rocks are so marked that the rock-unit distribution maps are used in plantation planning.

Point Hibbs Map Project

About 40% has been mapped of this generally heavily-forested region, which lies south of Macquarie Harbour in southwestern Tasmania. The oldest rock types are folded Precambrian quartzite and phyllite

with usually fault-bounded units of Cambrian felsic/intermediate volcanic rocks, sheared ultramafic rocks, and Ordovician and Devonian sedimentary sequences. The eastern areas are underlain by comparatively young flat-lying Tertiary sedimentary successions.

The Cambrian volcanic units, which elsewhere in Tasmania are associated with economically important base metal and gold deposits, are being accurately delimited for the first time, and major faults are being mapped in detail.

Vegetation types can be correlated with underlying rock-units, the distribution of which can be used in determining areas of good growth of certain flora, such as Huon Pine, as well as defining suitable environments for such rare fauna as the Orange Bellied Parrot.

Styx Map Project

This region lies east of Lake Pedder, with folded Precambrian and Cambrian rocks occurring at the western margin and flat-lying Parmeener Supergroup and younger rocks occupying the rest of the quadrangle. A total of 65% has been mapped of the folded rock units, which include quartzite and dolomite sequences, ultramafic emplacements and basalt lavas.

Investigations are being carried out on the timing of tectonometamorphic events, thrusting episodes, and ultramafic emplacements. The resulting information is expected to lead to more accurate predictions of suitable localities for economic deposits such as silica flour, dolomite, base metals/gold, platinum group elements etc. not only in this region but all of western Tasmania.

Karst-forming carbonate rock units are common, and knowledge of their distribution is important. Whilst karst-related features are a hazard to various operations, such as forestry, caves may be of value as archeological sites and for their spectacular beauty.

Trowutta Map Project

Some 55% of this quadrangle, which covers the densely vegetated middle Arthur River and Rapid River area south of Smithton in northwestern Tasmania, has been mapped. The region is occupied by folded Precambrian sedimentary sequences and metamorphic rocks, which are unconformably overlain in the west by folded Eocambrian–Cambrian rocks of the Smithton Basin. To the east flat-lying Permian sedimentary sequences and Tertiary basalt rest unconformably on the Precambrian rocks.

Many of the mineral deposits of alluvial gold, magnesite, copper and magnetite-pyrite appear to be associated with the metamorphic rocks of the 10 km wide NE-trending Arthur Lineament. Copper also occurs within the basalt of the Smithton Basin, where the presence of clasts of felsic-igneous volcanic rocks in

the deposits is of considerable interest in view of the association of similar rock types with mineralisation elsewhere in western Tasmania.

Variety and distribution of flora are related to soil types, which can be correlated with the underlying rock units. Trace element contents of the soils are dependent on the underlying rocks, and this has a direct bearing on the suitability of the farmed areas for cattle grazing and the growing of certain crops.

Swansea Map Project

Some 18% of the land at the western margin of this East Coast map sheet has been mapped. The mapped area is mostly underlain by extensive sheets of Jurassic dolerite with unfaulted Triassic coal measures and quartz-rich sedimentary rocks. Widespread alluvial areas north of the Swansea township represent Quaternary reworking of an older Tertiary landscape.

Zeehan Map Project

The advance of geoscience is such that, in general, revision of the older map sheets is required. It is accepted universally that the half life of most map sheets is 10 years. Already 25 of Tasmania's 1:50 000 and 1:63 360 scale Geological Atlas sheets are older than 10 years, with 15 of them older than 20 years. The Zeehan sheet, which was published 27 years ago, is now being revised because of its considerable importance to mineral exploration.

About 25% of the Zeehan Quadrangle has been re-mapped, with newly recognised areas of basalt-associated sequence and felsic volcanic associated successions delineated. The nature and patterns of the fault systems are receiving detailed investigations, and the general Lower Palaeozoic stratigraphy is being re-assessed.

EXPLANATORY NOTES

Explanatory Notes for the Lake River and Pedder Quadrangles have nearly been completed for publication, and notes for St Helens, Montgomery, Ben Lomond/Snow Hill and Lyell 1:50 000 map sheets are being compiled.

The Palaeontologist continues determining time constraints on rock units through studies of late Palaeozoic brachiopods, with the publication on the Tamarian Stage in *Alcheringa* and preparation of material for palaeontological studies of the Lower Parmeener Supergroup to be published in a series of four bulletins in the next few years.

ECONOMIC GEOLOGY

Compared with the previous year, the Section strength has increased to twelve officers. However, one geologist remains in the environmental monitoring role with another branch, and the administration geologist has been seconded to the Minister's office. This has reduced the number of geologists to six and, when combined with long service and sick leave entitlements taken by another geologist, meant delays in the completion of some projects and the postponement of others.

The remainder of the Branch consists of an executive officer in charge of the database to partially replace the administration geologist, two technical officers, and a field assistant.

REGULATION

Despite the reduced number of geologists, the branch continued to provide this important service to the mineral exploration industry. Exploration programmes, reports (186) and renewal applications were assessed for 125 exploration licences and 25 retention licences.

Exploration tenders (44) were also processed by the branch for 105 areas advertised under the Exploration Tender Area (ETA) system, and 20 new exploration licences were awarded.

MT READ VOLCANICS PROJECT

As part of this important special project, ten temporary employees are engaged in providing scientific information on the State's geology as a stimulus to mineral exploration companies. These staff comprise three geologists, one analyst, two database clerks, two field assistants, a technical officer and a draftsman.

MINERAL RESOURCE MAPPING

Geological mapping over the 1989–90 summer period was carried out in the Elliott Bay–Mt Osmund area of Southwest Tasmania.

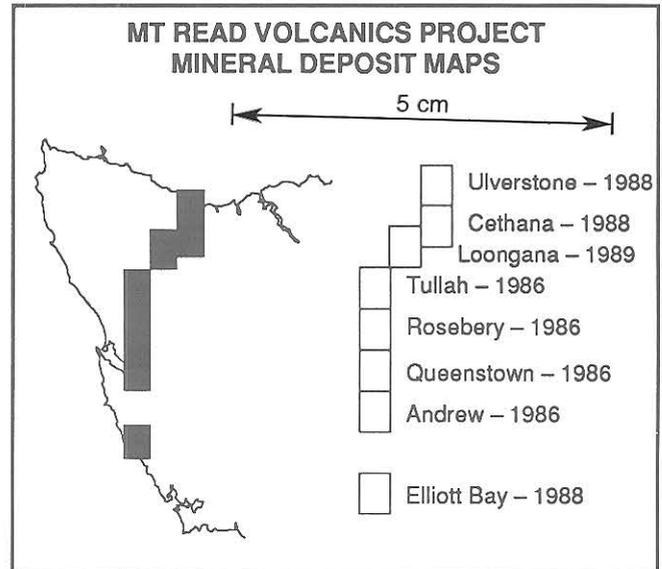
Operations in this most southern and isolated portion of the Mt Read Volcanics belt were helicopter supported, and the four field teams were based at the Wart Hill camp.

The mapping has confirmed a structurally-complex sequence of mainly felsic volcanic rocks containing several small massive sulphide lenses, intruded by a number of granite and porphyry bodies in fault contact with a sequence of sedimentary rocks and mafic volcanic rocks to the west.

During the year the Winterbrook–Moina map and the Queenstown map (produced jointly with Regional Mapping Section) were published (both at 1:25 000 scale) as were explanatory notes for Hellyer–Mt Charter and Tullah–Mt Block areas. Notes for Map 4 and Maps

7 and 8, as well as the summer map sheet, are currently being compiled.

Some 10 km north of Hellyer Mine, Department drilling to support Mt Read mapping has intersected, beneath some 200 m of Tertiary basalt, a 250 m thick sequence of Que–Hellyer Volcanics — the most northerly known occurrence of these highly prospective rocks.



ISOTOPE AND ALTERATION STUDIES

A preliminary report on the Henty Gold Prospect has been completed and detailed mineragraphic, fluid inclusion and isotope studies are continuing.

A major consulting report on alteration in the Rosebery area was completed, as were a number of other smaller consulting reports on fluid inclusion applications to ore genesis.

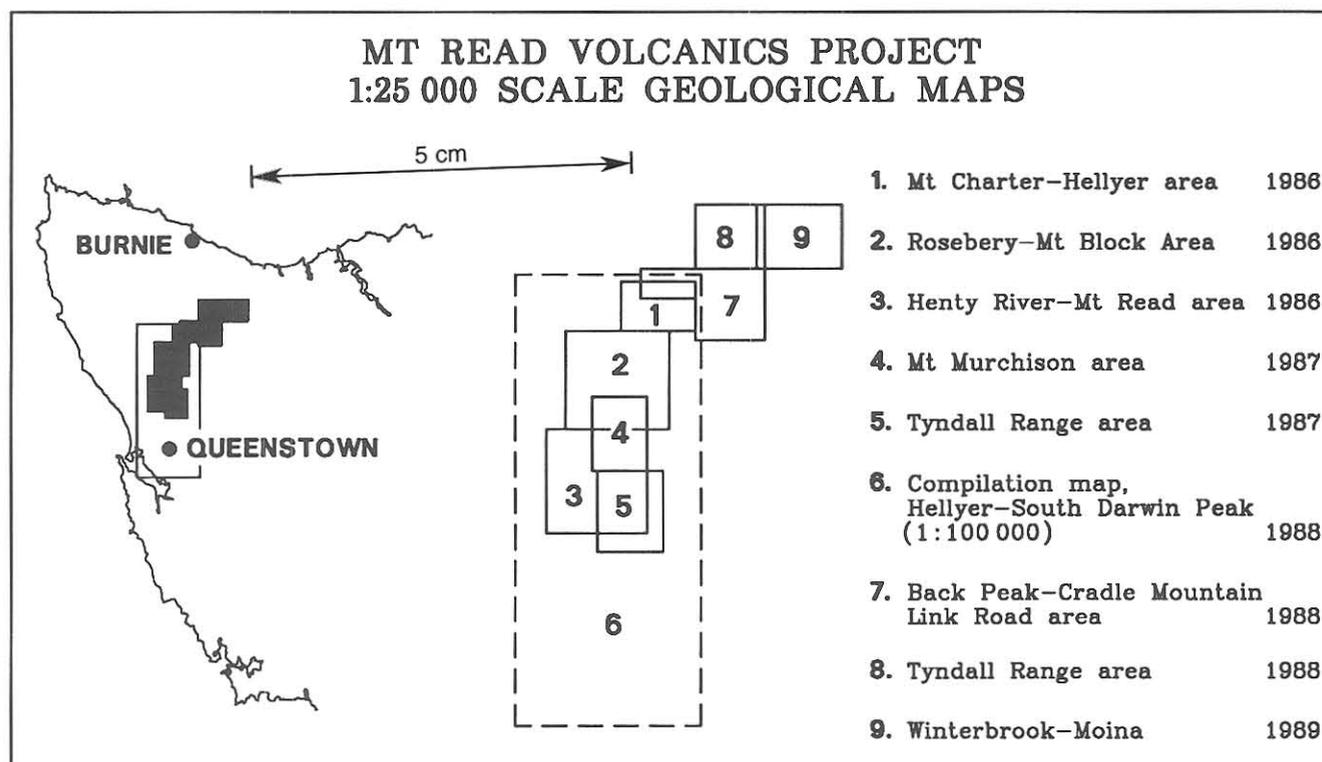
The Lakeside gold-tin deposit report still awaits publication due to lack of funds. Papers on this work and on the Rosebery–Hercules area were presented at the 10th Australian Geological Convention in Hobart in February.

DATABASES

The object of this project is to provide industry with computerised databases relevant to mineral exploration and mining in the State.

TAXSPLORE, the database of unpublished reports covering mineral exploration by companies from the beginning of this century, now contains 3500 entries and is continually being updated. The database is searchable by author, company, tenure dates, title, tenement number, map area and subjects. Microfiche of all open file reports are available for purchase.

DORIS, a drilling database, is now being developed to include details of all drilling carried out in Tasmania, whether Government or open file company drilling.



The details of 2120 drill holes were added this year, bringing the total number of entered holes to 8420. Gradual integration of this database with the GIS system will allow display of drill holes with geology and tenement information, for example, and provide valuable information on the focus of mineral exploration on a state-wide basis.

COMMODITY STUDIES

Gold

The database of Tasmanian gold deposits (on MIRLOCH) has 981 gold-bearing deposits entered. Research on lode gold deposits is continuing, initially in the Mangana-Mathinna area.

Three reports were produced on the Jane River goldfield:

- a preliminary account of the Department investigation of last year;
- mineralogy of heavy concentrates; and
- a brief history of prospecting.

Reports are in preparation on the Lake Chisolm gold prospect and reconnaissance surveys for the NETGOLD project. Two diamond-drill holes were completed at the Lisle goldfield, and revealed weakly mineralised, altered and veined granodiorite. Studies continued on the gold distribution in Mt Lyell ores and concentrates, and a paper was presented at the 10th AGC. A Mineral Resources Report on alluvial gold is in press.

Industrial Minerals

In general, little research has been carried out on these commodities because the geologist concerned continues to act in environmental monitoring.

As part of another project, two diamond-drill holes were completed near Corinna to investigate the origin of a silica flour deposit currently being mined.

Coal

The publication of the Coal Resources Bulletin has once again been delayed but is now scheduled for 1990-91.

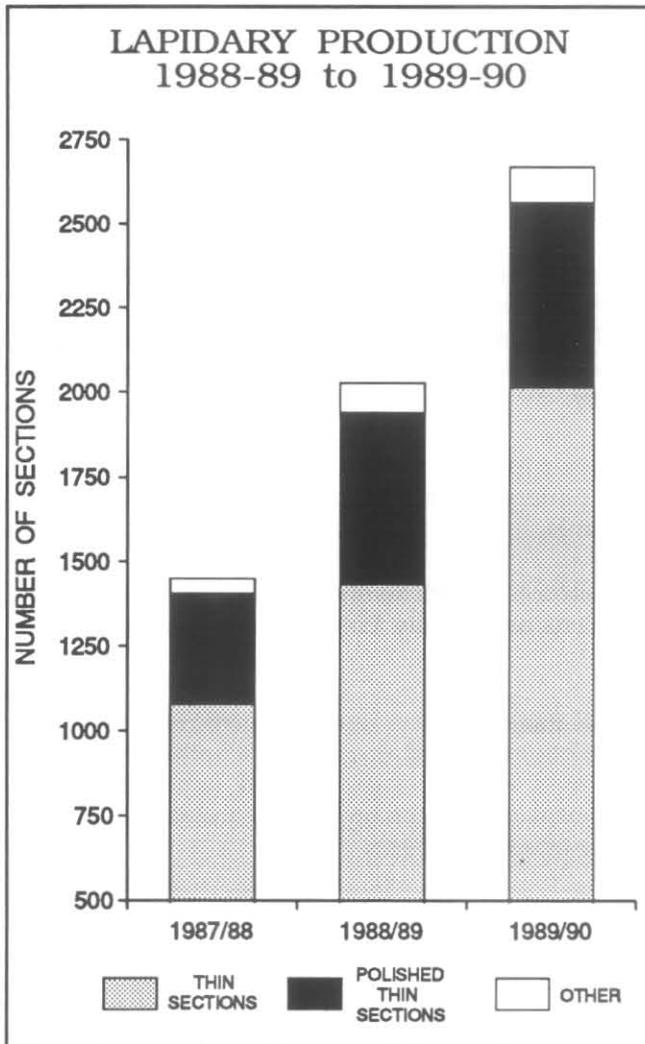
PETROLOGY

A total of 804 samples were received for investigation from the HEC, the Tasmania Police, various other Government departments, mining and exploration companies, consulting geologists, the general public and miscellaneous businesses. Samples studied include basalt, clay, chert, mineral concentrates, dolerite, gemstones, rocks, soils, sand, ore samples, aboriginal artefacts, asbestos, dusts, industrial materials, metallurgical products and wastes. A report was produced on aboriginal artefacts and related rocks. The determination of environmental hazards was in demand with dust (silica-bearing), asbestos and miscellaneous samples being identified on a contract basis.

Departmental work included studies of silica fume as a contribution to the National Working Group. The XRD unit was interfaced with a computer to assist with analysis.



Operations in South West Tasmania are made difficult by poor access. Field assistants Grant Eagling and Alistair Roberts are repairing the decking on an old bridge across the Lewis River near Low Rocky Point.



A total of 420 rocks have been petrographically described for the Mt Read Volcanics physical property database, while geochemical analyses and interpretation are about 30% complete.

Curatorial work has included the supervision of the rock and core stores, and upgrading of databases for

rock samples, drill logs, drillcore, mineral deposits and chemical data. The MIRLOCH database contains information on 1537 mineral deposits, including 792 gold, 129 tin-tungsten, and 346 base metal deposits. The TASROK database contains information on 1389 rock samples and about 1600 analyses are on computer in preparation for CHEMDAT.

Petrology Laboratories

The lapidarists prepared 543 polished thin sections, 2022 standard thin sections, and 80 miscellaneous sections, making a total throughput of 2645 samples. The technical officer processed 915 samples by X-ray diffraction, including 598 quantitative dust analyses, 121 quantitative clay analyses, and 196 routine identifications. He also conducted 33 stable isotope analyses, 139 optical asbestos identifications, and 115 physical property tests.

Training curriculums were prepared for the petrology technicians.

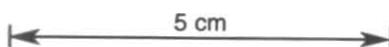
GENERAL

The following publications were produced during the year:

- seven reports
- two MRVP geological maps, 1:25 000 scale
- two MRVP geological map notes

Contributions were written for the Pedder and St Helens explanatory notes. The Corinna map sheet compilation was completed.

Three papers were presented at the 10th Australian Geological Convention in Hobart. Field guides were written for the tin/tungsten and Adamsfield district excursions, which were led by members of the branch, as was the Mt Read Volcanics excursion.



Interior of new core store at Mornington

The construction of the new core store at Mornington is now complete. In the coming year the core backlog currently held by industry on the Department's behalf will be accepted as core racks become available. It is estimated that the drill core will fill half the core store within one year and the remainder within ten years. Due to changes in priorities and restructuring, the Regional Mapping Section will now organise and run the core store.



Section members have become increasingly involved in mineral resource potential assessments of various parts of the State. Such assessments continue to be provided to Government for the Forestry Industry Council deliberations, and to other Departments for the impact of forest conservation on the mining and mineral exploration industry.

ENGINEERING GEOLOGY AND GROUNDWATER

For the first half of the year the Section consisted of one acting deputy chief geologist, one senior geologist, three project geologists, one special project geologist, and a surveyor. At the end of November the senior geologist retired and subsequently two of the project geologists were appointed acting senior geologists. The special project geologist completed his appointed period in April. From January to March a geologist was appointed to advise and report on refuse waste disposal areas. The retirement of the senior geologist leaves two unfilled vacancies in the Section.

The Section has been involved in a wide variety of work which has included long term projects and short term work, the latter often being the result of requests for advice from the public, other Government departments and local Government. Advice on the selection of sites for waste disposal and the prospect of groundwater pollution is an increasing facet of the short term work. Advice on land stability continues to form a significant proportion of the advisory service work.

LAND STABILITY

Advice on land stability of numerous subdivisions and individual lots has been given. These areas have been largely concentrated on the North West Coast and the Tamar regions, although several investigations have been undertaken in southern Tasmania. Detailed examinations of landslides at Sulphur Creek (which threatened a house) and at Ulverstone (which affected a dam) were undertaken. A comprehensive study of the

cause of damage to houses at Hone Road, Rosetta commenced in the latter part of the year.

A major project to broadly map the unstable and potentially unstable areas in the coastal strip between Port Sorell and Stanley commenced and will involve several hundred square kilometres of land. When completed this will be of particular use to regional planners and developers.

Monitoring of landslide movement by survey and with continuous monitoring devices has continued in a number of areas including Penguin, Ulverstone, Devonport, Launceston, Windermere, Taroona and Rokeby.

Telecom requested advice on stability of land along a fibre optic cable route to Mt Dismal in northern Tasmania.

Compilation of work involving land stability studies at St Helens and Beauty Point commenced during the year.

Several thousand land transfers were referred to the Department for advice as to whether the land concerned is part of proclaimed landslide areas. Additional information on stability and soil conditions is often attached to these.

GROUNDWATER

Advice on groundwater prospects has been given and surveys undertaken at a large number of locations throughout the State. Compilation of the major investigation into groundwater resources in northeast Tasmania has continued. This study is concerned with most of the area between the River Tamar and the East Coast, and will be an important addition to the knowledge of the groundwater resources in the State.

A study of groundwater resources in the Sheffield area is also in the compilation stage. Most of the field work



During the year the Engineering Geology and Groundwater Section became involved in investigations into the cause of house damage at Hone Road, in the Hobart suburb of Rosetta. The damage, which has been caused by a landslide, resulted in the demolition of one house (above) and caused severe damage to several other houses.

To monitor some of the effect of this movement Unidata loggers were installed on some houses. The loggers were connected to displacement gauges mounted across cracked sections of the houses (left below) to monitor change in the size of the gap.



has been completed, including drilling, electric logging and pump testing. Levelling of the drill holes has been completed.

A start has been made on the installation of a series of groundwater monitoring holes throughout the State. It is proposed to establish holes in varying rock types and climatic conditions. These holes will have continuous monitoring devices installed in them so that standing water level response to rainfall, or lack of it, can be

measured. It is also intended to examine any quality variations. A total of 20-30 such bores will be installed.

Groundwater levels and quality continue to be monitored in the East Devonport-Port Sorell-Sassafras area. This region has the greatest use of groundwater within the State. To date the water levels have tended to recover completely after winter rains except in one small part of the area. A detailed study of the groundwater resources in this area was completed some years ago and a report dealing with this work is in the editorial phase, and should be ready for publication in the near future.

The Groundwater Committee met once during the year. This meeting was combined with an excursion and explanation of the groundwater resources of the Scottsdale area.

URBAN ENGINEERING GEOLOGICAL MAPPING

The joint project with local Government in the Hobart region involving a survey of soil and rock properties has been completed and the results are being prepared for publication. Arrangements have been made to

undertake similar surveys in the urban area of Launceston and its surrounds, as well as at Ulverstone on the North West Coast. These surveys will commence in the early part of 1990–91.

WASTE DISPOSAL SITES

A geologist from Switzerland with specialist knowledge of the effects of refuse waste disposal on groundwater quality was employed from early January to the end of March to undertake a survey of major tip sites throughout the State. A comprehensive report of geological and groundwater conditions around about 70 disposal sites was prepared, as well as guidelines for siting tips so that the risk of groundwater pollution will be minimised.

Many local government councils are establishing new tips, and a large proportion of these have been examined to determine the risk of groundwater pollution from leachate. This has involved surface inspections and subsurface investigations in many cases. The groundwater conditions around the Exeter tip, where there was some soil contamination from agricultural chemicals, was examined.

The disposal of other wastes, mainly fish waste, has been the subject of several inspections. Advice has been given on the disposal of liquid and solid waste from vegetable processing factories. In particular, a proposal at Scottsdale to irrigate a forest plantation with water carrying considerable quantities of nitrogen posed some risk to groundwater quality in the region.

FOUNDATION STUDIES

Foundation conditions have been examined around a number of structures. These examinations have included vibration studies around a pipeline from Ridgeway to Kingston, seismic surveys at a reservoir site at Cambridge, vibration studies on the effects of pile driving at Devonport, and drilling near a river at Richmond for the southeast irrigation scheme.

MISCELLANEOUS

One member of the staff attended the Tasmanian Enterprise Workshop. Staff members have conducted courses on geology for engineers at the University of Tasmania, and on engineering geology at the Hobart Technical College. Surveys have been undertaken to position boreholes accurately at a number of locations and several lease boundaries have been surveyed.

GEOPHYSICS

GENERAL

The Geophysical Section provides geophysical and computing advice and services for both divisional and other users, acquires and/or processes basic regional data, and reviews the geophysical activities of the exploration industry. Products of particular interest

have been the re-processed aeromagnetics from Mangana–Alberton and Lisle, and the residual gravity anomaly maps. The section is staffed by the Supervising Geophysicist and a Technical Officer (Electronics).

The section participated closely in a review of the classifications of all Technical Officers and in the development of a training and accreditation scheme for Technical Officers. The successful Tenth Australian Geological Convention was held in Hobart in February and in addition to co-authoring a paper the Supervising Geophysicist was Financial Manager of the Convention.

GRAVITY–MAGNETICS

Gravity data acquisition was predominantly in the Maydena–Tarraleah, Deloraine–Deviot, Midlands and Adamsfield areas. Of the 3096 stations occupied 1433 were joint ventures with the exploration industry. With the exception of the Adamsfield area all data were acquired using available tracks and roads to maximise productivity. Old data of questionable accuracy were re-read along the Lake Leake Road and near Ansons Bay. Several parcels of data were reduced for other operators.

The aeromagnetic data from Alberton–Mangana (Mines Department) and Lisle (Seltrust, 1985) have been reprocessed to both a uniform terrain clearance and a constant barometric altitude. Interpretation reports are available and a number of possible drill sites were suggested.

COMPUTING

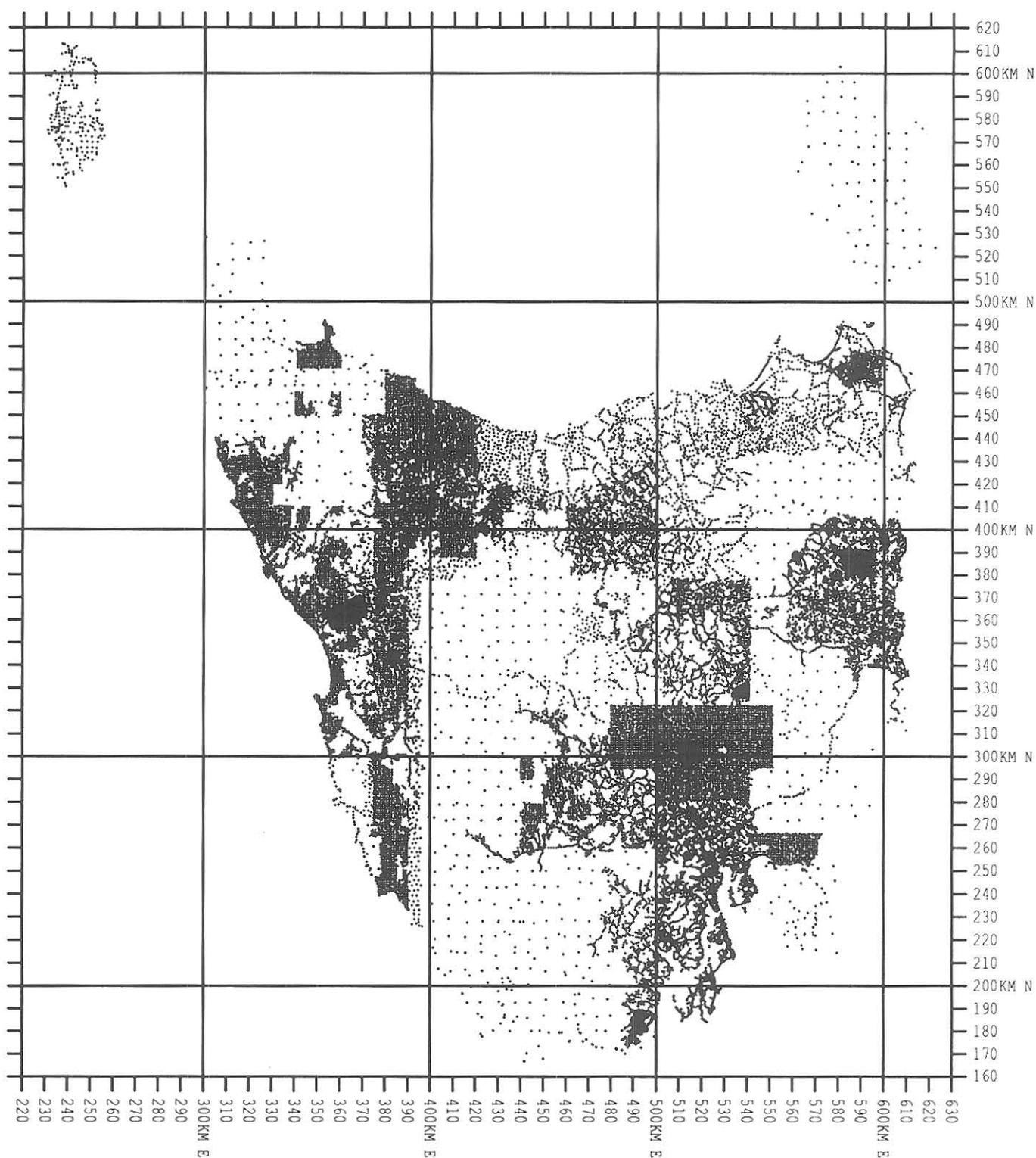
Use of the mini-computer has continued at a high level. In addition to gravity and magnetic data processing, database searching has been a major component. A partial Ethernet has been established and links two Sun 386i workstations and several personal computers. As funds permit it will be extended to link other systems within the Rosny Park building. Small networks now provide links between the CAD systems and between the Macintosh personal computers. Minor modifications and improvements have been made to most of the databases.

The section has been actively involved in producing 1:25 000 contour maps for the Osmund and Lewis sheets from digital elevation models, a first for the State.

ELECTRONICS

A comprehensive review of the computing requirements of the Launceston Laboratories was completed in September and detailed specifications were compiled in November. Particular attention was paid to the instrument control and multi-user aspects. An evaluation of the GBC atomic absorption spectrophotometer enabled a suitable spare parts kit to be assembled, and the instrument now has good serviceability.

DISTRIBUTION OF TASMANIAN GRAVITY STATIONS



Documentation was completed for the XRF sample carousel, the logger replay unit, and the synchronised shot boxes. Formal type approval has been gained for the shot boxes. New displacement measuring systems have been developed for the Unidata data loggers and several installations have been completed.

In addition to routine divisional repairs, instrument repairs have been effected for a number of other clients.

GEOCHEMISTRY

The major activity of the Section continues to be the application of the Huminex (geochemical exploration) System. Additions have been made to the range of elements available in the soil application of the system, which now includes arsenic, bismuth, copper, gold, lead, molybdenum, silver and zinc.

5 cm

Development of the water application of the system has been completed and it is now commercially available. This application is being subjected to detailed evaluation within mineral exploration activities in northwest Tasmania. The system was patented during the year and the name 'Huminex' was registered as a trade mark.

A Total Organic Carbon Analyser has been added to the laboratory equipment as essential equipment in the viable application of the Huminex System. This equipment is also being used in environmental investigations.

PETROLEUM EXPLORATION AND MARINE GEOLOGY

GENERAL

The Section is responsible for technical and policy aspects of petroleum exploration in Tasmanian offshore and onshore areas, and in addition to providing technical and other advice concerning administration of the relevant Act, performs reviews and conducts research projects relating to the geological evolution and prospectivity of the offshore and onshore sedimentary basins. The Section is staffed by the Petroleum Geologist receiving specialist input from other departmental officers as required.

As part of its medium to long-term programme, the Government has set up an inter-agency Natural Gas Steering Committee and an associated Working Group, consisting of representatives from the Hydro-Electric Commission, the Tasmanian Development Authority, and the Department of Resources and Energy. The Mines and Mineral Resources Division is represented on the Steering Committee by the Acting Director, and on the Working Group by the Petroleum Geologist. Among options under consideration is possible development of the Yolla field.

The Division took part in the Work Experience program of the National Centre for Geology and Geophysics, Adelaide. Honours student Andrew Cox spent six

weeks working in Hobart on his project studying the offshore Pelican gas field.

The Petroleum Geologist was Convener of the Tenth Australian Geological Convention which was held in Hobart from February 4–9. The convention attracted over 550 registrants from Australia and overseas.

OFFSHORE

Amoco and their joint venture partners have applied for a Retention Lease over the Yolla discovery (T/14P) drilled in 1985.

Current offshore exploration permits are shown as Table 2; the number of exploration permits increased over the level of the previous few years with the granting of new permits to the Shell Company of Australia in the Bass Basin (T/23P) and Maxus Energy Corporation of Dallas in the Sorell Basin (T/24P). A single area in the Bass Basin (T89-5) was made available for work programme bidding as part of the Second 1989 Offshore Release, but no bids were received.

Two seismic surveys by Shell in T/14P, T/18P and T/23P acquired some 933 line km of new data. Maxus completed reprocessing of the Amoco W-81 Seismic Survey (Sorell Basin). Because of the poor condition of the tapes, this valuable dataset would have been lost within a year or two had this reprocessing not taken place.

ONSHORE

Conga Oil Limited (EL 1/88) continued their search for Ordovician-sourced hydrocarbons beneath the Tasmania Basin.

An application for NERDDEC funding to reappraise the petroleum potential of Tasmania was made in conjunction with CSIRO Division of Oceanography and the Geology Department at the University of Tasmania.

Table 2

OFFSHORE PETROLEUM EXPLORATION PERMITS

Title	Holder	Blocks	Expires
T/14P	Amoco Aust. Petroleum Co. and others	25	24.08.1992
T/15P	Weaver Oil and Gas Corp. Aust and Dorchester International Inc.	136	26.05.1992
T/18P	Amoco Aust. Petroleum Co. and others	59	24.08.1992
T/22P	Amoco Aust. Petroleum Co. and others	52	03.09.1990
T/23P	Shell Company of Australia	38	22.12.1995
T/24P	Maxus Energy Corporation	72	02.01.1996

GEOLOGICAL SUPPORT SERVICES

CARTOGRAPHIC DRAFTING

The following progress was made on colour map production.

1:50 000 Geological Atlas Series

Snow Hill — drafting commenced

Corinna — drafting commenced

1:25 000 Mt Read Volcanics Project Geological Maps

Winterbrook-Moina Area — drafted and printed

Queenstown — drafted and printed

1:50 000 Metallic Mineral Deposit Maps

Loongana — drafted and printed

1:25 000 Engineering Geology

Greater Hobart Area (Maps 1 & 2) — drafted and printed

Northeast Groundwater

Scottsdale Basin Geology (1:60 000) — drafting commenced

Winnaleah Geology (1:100 000) — drafting commenced

Lilydale Geology (1:100 000) — drafting commenced

The majority of the drafting for geological bulletins, unpublished reports and other support services has continued to be handled by our two Computer-Aided Drafting work stations.

Earlier in the year we commenced a pilot project for the Department's Geographical Information System (GIS). This project was to capture, in digital form, all the information on the State 1:500 000 geological map.

LIBRARY

STAFF

The position of Library Assistant was left vacant during the year with the resignation of the previous incumbent. A new Library Assistant was appointed early in 1990 to fill the position.

COLLECTION

The book stock continued to expand, albeit slowly, due to financial constraints. Emphasis was placed on the areas of ore geology, dangerous goods storage and transport, environmental publications and engineering geology.

REFERENCE AND INFORMATION

During the year 405 items were borrowed by staff. There were 1619 reference queries handled by the library staff. Of these, 978 were classed as ready

reference, while 641 required more detailed literature searches. In addition, 228 computer searches were conducted for both staff of the Division and outside users. The library had 654 outside users during the year and 1495 Open File reports on both mineral and petroleum exploration were consulted.

The TASXPLORE data base has continued to be successful. It was used extensively during the pilots' strike in late 1989 when travel was difficult for interstate geologists.

The reports relating to the Exploration Tender Service continue to be available through the library in hard copy and in microfiche.

TECHNICAL SERVICES

The INMAGIC software is now operational in the library with all new monographs and series additions being entered on the computerised database.

This system is also being used to generate accession lists which are being produced regularly.

PUBLICATIONS

The following publications were printed during the year:

- Report of the Director of Mines for 1988-89
- Mines News Issue 24
- 1:50 000 Explanatory Report - *Interlaken*, by S. M. Forsyth
- 1:50 000 Explanatory Report - *Smithton*, by A. V. Brown
- Geological Survey Bulletin 65 - *Stratigraphy, sedimentology and structural setting of the Cambrian Sticht Range Formation, western Tasmania*, by P. W. Baillie.
- Mt Read Volcanics Geological Report 2 - *Geology of the Tullah-Mt Block area*, by A. W. McNeill and K. D. Corbett.
- Mineral Resources of Tasmania 12 - *Silica*, by C. A. Bacon

Publications in progress at year end included the explanatory notes for the Pedder and Lake River quadrangles, bulletins on the State's coal resources and the groundwater resources of the Devonport-Port Sorell area, and further geological reports in the Mt Read Volcanics series.

Forty-three reports (Table 3) and two consultancy reports were issued during the year, and a number of leaflets were prepared and printed. The demand for publication services from other sections of the Division has increased significantly, both in quantity of items and type of material.

Table 3
REPORTS ISSUED DURING 1989-90

<i>No.</i>	<i>Title</i>	<i>Author</i>	<i>Date</i>
1987/01	Review of the Upper Parmeener Supergroup	S. M. Forsyth	14.12.89
1987/07	Metamorphism in the Precambrian rocks of the Tyennan Region—a review.	J. L. Everard	31. 3.90
1989/17	PUMPTTEST, a template for water bore pump test data reduction using Lotus 1-2-3.	B. D. Weldon	5. 7.89
1989/20	Control of the TEAC tape replay unit.	R. J. Sedgman	18. 9.89
1989/21	TASROK — a computer-based catalogue for Tasmanian rocks (Revision 3)	R. G. Richardson	6. 7.89
1989/22	Transfer of water bore records from the Perkin-Elmer mini-computer to an IBM micro-computer for use in Lotus 1-2-3.	B. D. Weldon	7. 7.89
1989/23	SAMPROP — A data base for basic physical property data from samples and drill core (Revision 1).	R. G. Richardson	6. 7.89
1989/26	FORTRAN programs for the implementation of MIRLOCH (Revision 2).	R. G. Richardson	11. 7.89
1989/27	Groundwater investigations at Freycinet Peninsula.	D. J. Sloane	11. 7.89
1989/28	Mineralogy of heavy concentrates, Jane River Goldfield.	R. S. Bottrill	10. 7.89
1989/29	PLANAR: a QuickBasic program for planar stability analysis on an IBM compatible micro-computer.	B. D. Weldon	12. 7.89
1989/30	Supplementary seismic survey – Proctors Road area.	W. L. Matthews	24. 7.89
1989/31	Activities of the Regional Geological Survey Branch.	E. Williams	31. 7.89
1989/32	A brief history of the Jane River goldfield.	C. A. Bacon	11. 8.89
1989/33	Investigation of a proposed dam site at Nubeena.	W. L. Matthews	16. 8.89
1989/34	Petrology of some Aboriginal artefacts and rocks from north-west Tasmania.	R. S. Bottrill & D. B. Seymour	1. 9.89
1989/35	Modifications to the XRF autosampler at the Department of Mines Launceston Laboratory.	R. J. Sedgman	14. 9.89
1989/36	The Mt Read Volcanics Project — Gravity sub-project.	R. G. Richardson	28. 9.89
1989/37	The vertical continuation of aeromagnetic data.	R. G. Richardson	28. 9.89
1989/38	Terrain clearance variation during aeromagnetic surveys in areas of rugged topography.	R. G. Richardson	20.10.89
1989/39	Preliminary report on Stonehenge Diamond-drill Holes 1 and 2, and similar rocks in an Amoco diamond-drill hole near the old Nubeena mine.	A. V. Brown	1.11.89
1989/40	Orthopyroxene-rich ultramafic-mafic rocks from western Tasmania and their PGE contents.	A. V. Brown	3.11.89
1989/41	Fold related mesoscopic structures in the Mathinna Beds: Field relationships compared with text-book relationships.	E. Williams	17.11.89
1989/42	Mega-kinking in the Mathinna Beds, north-east Tasmania.	B. D. Goscombe & R. H. Findlay	28.11.89
1989/43	Results of a water bore in Ordovician quartzite, Lune River area.	W. L. Matthews	20.11.89
1990/01	Field manual for the operation of the magnetic susceptibility tool.	R. J. Sedgman	12. 1.90
1990/02	Instructions for the use of the remote-firing shot boxes Model RFB-1-TDM.	R. J. Sedgman	2. 2.90
1990/03	The application of soil humic substances to soil geochemical exploration.	W. E. Baker	20. 2.90
1990/04	Conodonts as indicators of mineral prospectivity.	P. W. Baillie & C. F. Burrett	12. 3.90
1990/05	Completion report: Sub-basalt drilling Project Hole 7.	P. W. Baillie & G. R. Green	12. 3.90
1990/06	Limestone resources of the Maydena-Florentine area.	C. R. Calver	23. 3.90
1990/07	Guidelines for tip siting (domestic wastes) and monitoring.	O. Gentzen	4. 4.90
1990/08	Geological and hydrogeological setting of the main tip sites throughout Tasmania.	O. Gentzen	5. 4.90
1990/09	Use of the Magellan GPS Nav 1000 Pro in a helicopter.	R. G. Richardson	30. 4.90
1990/10	Operations report — 1989/90 helicopter gravity survey.	R. G. Richardson	30. 4.90
1990/11	A leachate monitoring programme at the Lauderdale landfill site.	B. E. Cox	4. 5.90
1990/12	Preliminary report on the occurrence of Au-Ag-Te mineralisation in the Henty Prospect, Tasmania.	J. Taheri & G. R. Green	8. 5.90
1990/13	The Lisle aeromagnetic survey — a brief interpretation.	R. G. Richardson	29. 5.90
1990/14	Formation water resistivities in the upper Eastern View Group, Bass Basin.	P. W. Baillie	25. 5.90
1990/15	The Mt Cameron Water Race — A century of operation.	G. J. Dickens	12. 6.90
1990/16	Jane River Goldfield — Rock analyses and preliminary account of investigation.	N. J. Turner	6. 6.90
1990/17	Examination of a proposed subdivision at Huonville.	B. D. Weldon	15. 6.90
1990/18	A landslide investigation at the Pleasant Hills subdivision, Legana.	B. D. Weldon	25. 6.90

CHEMICAL AND METALLURGICAL BRANCH

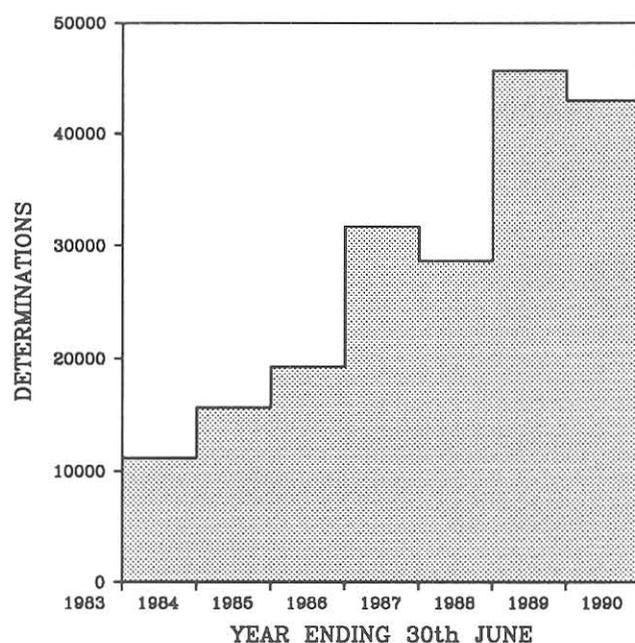
INTRODUCTION

The past year has seen a consolidation of activity within the Branch, and the Branch's responsibility for supplying an effective analytical and metallurgical service to the Government, industry and the public has been fulfilled successfully.

A total of 109 companies and individuals used the laboratory service during the year. This useage varied from some companies, such as Tasmania Mines, sending samples every working day, to others such as prospectors or a bore water driller who would send in only one sample.

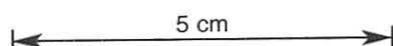
The type and number of individual samples received into the laboratories during the year is summarised as follows:

Type of Sample	Number of Samples
Water	1836
Industrial liquor	159
Metal or alloy	122
Metallurgical product	2800
Rocks	1162
Minerals	<u>626</u>
	<u>6705</u>



INCOME

The total income actual and notional generated from the laboratory activities and the general office for 1989-90 amounted to \$272,498.55, compared to \$201,672 for 1988-89.



The income for 1989-90 is made up as follows:

- Laboratory fees invoiced to outside clients, including metallurgical work, totalled \$118,362.40
- Value of laboratory work done for the Geological Survey Branch was \$68,916.55
- Value of work done for other agencies was \$2,010.50
- Miscellaneous account. This comprises income from the sale of Prospectors Licences, Miners Rights, Geological Survey maps and Magazine Fees, and amounted to \$83,209.10

CHEMICAL SECTION

The total number of determinations for the year was 41 798. This is made up of the following analysis:

X-ray fluorescence	20 511
Atomic absorption	10 208
Fire assays	745
Miscellaneous	10 334

The X-ray Fluorescence Spectrophotometer (XRF) did not operate during February and March because of electronic problems, and these took a considerable effort to locate and remedy. The XRF is now ten years old and has a limited life of five more years. The replacement cost today is \$360,000.

The closing down of the Beaconsfield gold operation has seen a reduction in the number of fire assays done this year.

Day to day monitoring of the Tasmania Mines Kara Mill samples for tungsten and iron continued, with this company using the Launceston Laboratory as their 'Control Laboratory'. Spectrum Resources Anchor Mine also used this laboratory as a control laboratory.

A total of 1162 rocks were analysed for major or minor elements for the Geological Survey Branch of the Department.

Analysis of environmental waters continued, mainly for Aberfoyle, Que River and Spectrum Resources. Bore water analysis for drillers also constituted considerable work.

Work for prospectors was at a lower level for the 1989-90 financial year compared to the previous year, and this results from the issuing of a lesser number of miners' rights and prospectors' licences.

A laboratory quality manual was written, as this is now a prerequisite for being a member of National Association of Testing Authorities (NATA). This manual describes the laboratory, equipment in the laboratory, and the type of analysis carried out.

Most laboratory staff attended a one-day seminar in Hobart run by Perkin Elmer for the graphite furnace. One laboratory technician attended a three-day seminar in Melbourne run by Varian for Atomic Absorption.

A start has been made on the Hay Points System which identifies in what functions a technician needs more training.

METALLURGICAL SECTION

The Metallurgical Section dried, crushed, ground and riffled 3954 solid samples for the Chemical Section.

Pasminco used six flotation cells in the pilot plant to carry out testwork to upgrade a large sample of their bulk lead and copper concentrate. After this testwork was completed in March Pasminco hired ten pilot plant flotation cells for their flotation circuit at Rosebery, and are operating these hired cells for 8 hours a day, 5 days per week, to carry out the final testwork on upgrading their bulk lead and copper concentrate. The conclusion of this testwork will then determine the type and arrangement of their new flotation machines. The cost to Pasminco for the hire of the ten pilot plant flotation cells is \$2,600 per month.

Spectrum Resources hired the six flotation cells for a period of two months to carry out testwork to float out sulphide in their tin concentrate at the Anchor Mine. This testwork is now completed and Spectrum Resources have purchased a full-scale flotation cell.

The Metallurgical Section has carried out consulting work periodically at the Anchor Mine during the past year to help increase the tin recovery and thus continuance of operation.

Considerable small-scale metallurgical test work was done during the year and is summarised below.

<i>Type of Test</i>	<i>Number of Tests</i>
Sizing analysis and screening operations	174
Magnetic separation	43
Panning	17
Cyanidation	99
Jigging	112
Tabling	157
Gold smelting, retorting, amalgamation	5
Specific gravity, pulp density	86
Flotation	5
Roasting, ashing	25
Heavy liquid separation	221
Cyclosizing	17
Pulping, decantation, settling	14
Crushing and grinding	5
Drying	9
	<u>989</u>

The estimated revenue raised from hiring out pilot plant equipment, small-scale metallurgical testwork, and project work was \$40,000.

RESEARCH INVESTIGATIONS

<i>Type</i>	<i>Number of Tests</i>
Magnesite	1 (parts 1 to 9)
Magnetite	1
Gold	3
Silica	1 (parts 1 to 5)
Tin	2
Mixed minerals	1

SUMMARY OF INVESTIGATIONS

MAGNESITE

R902 (Part 1 to 9)

Beneficiation of Magnesite – Mineral Holdings

Nine investigations and reports were issued during the year on the beneficiation of Arthur River magnesite. This deposit is in the order of 1000 million tonnes of magnesite grading up to 46% MgO and with the Fe₂O₃ decreasing at depth.

Calcination tests were carried out at 800°C and 1350°C and gave products containing up to 92% MgO. When the magnesite was crushed to minus 19.0 mm and screened on a 1.18 mm screen, then calcined for 1½ hours at 1350°C and cooled and again screened on a 1.18 mm screen, 72.5% by weight was recovered as oversize. The oversize was 0.8% higher in MgO and 0.3% lower in Fe₂O₃ when compared to the unscreened calcined head sample.

MAGNETITE

R910 — Cleaner Magnetic Separation – Tasmania Mines

Tasmania Mines do not have a cleaner magnetic step available and sent samples to the Division of Mines and Mineral Resources to investigate the effect on grade of a cleaner magnetic step. This showed an increase in grade of acid soluble iron of 1% and a decrease in silica of 0.6%, and the cleaner concentrate comprised 96.9% of the head sample.

GOLD

R903 (Part 1 to 3) — Forester Ore – G. Fisher

A one tonne parcel of Forester Ore was crushed to minus 7 mm and a representative sample cut out for further processing.

One sample was further crushed to minus 0.87 mm and concentrated on a Deister laboratory table. Of the head sample containing 13.8 grams gold per tonne and 9.2

grams silver per tonne, the table concentrate recovered 48.4% of the gold and 53.3% of the silver.

A second sample was again crushed to minus 0.87 mm and cyanided for 24 hours at 0.2% NaCN and 0.6% CaO. Gold recovery totalled 83.6% and 78% of the silver was recovered in the cyanide solution.

A third sample was ground to minus 0.15 mm and cyanided for 24 hours at 0.2% NaCN and 0.6% CaO. A total of 90.1% of the gold and 73.7% of the silver was recovered in the cyanide solution. Use of weaker cyanide solution at 0.1% saw a drop in gold recovery down to 81.4% and silver of 65.3%.

R905 (Part 1 and 2)

Golden Gate tailings dump, Mathinna – A. White

A spiral concentration test was carried out on a 1.4 tonne composite sample from Mathinna tailings dump. Of the head sample containing 1.5 grams gold per tonne, 11.3% of this gold was recovered in the spiral concentrate assaying 9.2 grams gold per tonne. Tablings of this spiral concentrate increased the grade to 385 grams per tonne but reduced the overall gold recovery to 8.7%.

R907 — Recovery of Gold from Screen Oversize – BPV Mining

BPV at present are producing a screen oversize of minus 6 mm plus 0.8 mm which is not suitable for cyanidation and is being stockpiled. This material contains a considerable amount of wood.

The laboratory investigation showed that 82% of the material reporting to the oversize was actually minus 0.8 mm so improved screening would largely overcome this problem.

SILICA

R904 (Part 1 to 5)

Beneficiation of Silica Flour – Mineral Holdings

A number of quartzite and silica flour deposits which are low in iron, i.e. below 0.02% Fe₂O₃ exist on the

northwest coast of Tasmania. Silica flour with an Fe₂O₃ content below 0.005% becomes available as a raw material for crystalware and electronic equipment.

Beneficiation tests such as wet screening on a 0.25 mm screen and discarding the plus 0.25 mm material and the decanted wash can produce, in some deposits, a silica flour as low as 0.006% Fe₂O₃ and constituting 85% of the head sample.

TIN

R908 — Reduction of the copper content of tin concentrates from the Anchor Mine – Spectrum Resources

Spectrum Resources are penalised by the tin smelter for copper content in tin concentrate in excess of 0.1% copper, and shipments containing more than 2% copper can be rejected.

Bench-scale flotation tests lowered the copper in the tin concentrate of the Anchor Mine from 2% down to 0.3%. Spectrum Resources have now installed a full-scale batch flotation cell to remove copper sulphide from their tin concentrates.

R909 — Examination of high tension electrostatic separator tailings – Spectrum Resources

This study showed that re-treatment of high tension electrostatic separator tailings will produce a concentrate suitable for inclusion in shipment concentrates.

MIXED MINERALS

R906 — Recovery of minerals from Macquarie Harbour sediments – Cottesloe Corporation

This testwork covered methods used to recover valuable minerals from the Macquarie Harbour sediments, and showed that both tabling and flotation would recover a concentrate which contained significant amounts of copper, cobalt, gold and barium, largely in an iron pyrite concentrate.

STATISTICAL TABLES

Table 4
EMPLOYMENT AND ACCIDENT STATISTICS 1989–90
(IN ACCORDANCE WITH AUSTRALIAN STANDARD AS1885)

<i>Employer</i>	<i>Work Hours Exposure</i>	<i>No. of Injuries</i>	<i>Days Lost</i>	<i>No. of Emp.</i>	<i>Frequency Rate</i>	<i>Incidence Rate</i>	<i>Mean Duration</i>
Aberfoyle—Hellyer	492 304	13	218	239	26	5	16.8
Aberfoyle—Que River	177 458	15	216	97	85	15	14.4
Anchor Mine	36 013	7	28	18	194	40	4.0
Beaconsfield	20 958	1	15	12	48	9	15.0
King Island Scheelite	174 042	13	126	98	75	13	9.7
Mount Lyell	1 192 807	105	2 004	539	88	19	19.1
Pasminco Rosebery	935 684	128	1 521	474	137	27	11.9
Renison	897 361	51	683	411	57	12	13.4
Savage River	657 292	50	681	326	76	15	13.6
Tasmania Mines	53 959	2	8	26	37	8	4.0
Tonganah Clay	30 174	2	3	19	66	10	1.5
BPV Mining	15 564	2	13	8	129	26	6.5
All Mines	4 683 616	389	5 516	2 266	83	17	14.2
Comalco	2 128 314	55	677	1 082	26	5	12.3
Goliath Cement	481 569	23	417	234	48	10	18.1
Mole Creek	46 420	4	68	22	86	18	17.0
MK Silica	17 741	3	6	10	169	30	2.0
Pasminco Risdon	2 862 715	178	2 831	1 438	62	12	15.9
Pioneer Silicon	125 170	30	634	68	240	44	21.1
Port Latta	315 909	26	283	155	82	17	10.9
Temco	914 714	63	963	434	69	15	15.3
Tioxide Aust.	1 040 380	25	410	540	24	5	16.4
Ceramics	150 889	36	300	87	239	41	8.3
All Works	8 083 821	443	6 589	4 071	55	11	14.9
Collieries	220 447	46	432	136	209	34	9.4
Quarries	216 566	13	98	107	28	5	15.0
TOTALS	13 204 450	891	12 635	6 580	67	14	14.2

DEFINITIONS

FREQUENCY RATE

This is the number of lost-time injuries in the year, related to a million work-hour unit, as follows:

Lost time injury frequency rate = Number of lost-time injuries × 1 000 000 / Work-hours exposure

INCIDENCE RATE

This is the number of lost-time injuries × 100/Number of employees

MEAN DURATION RATE

This is the time lost per lost-time injury, as follows:

Mean Duration = Days lost (shifts) / Number of lost-time injuries

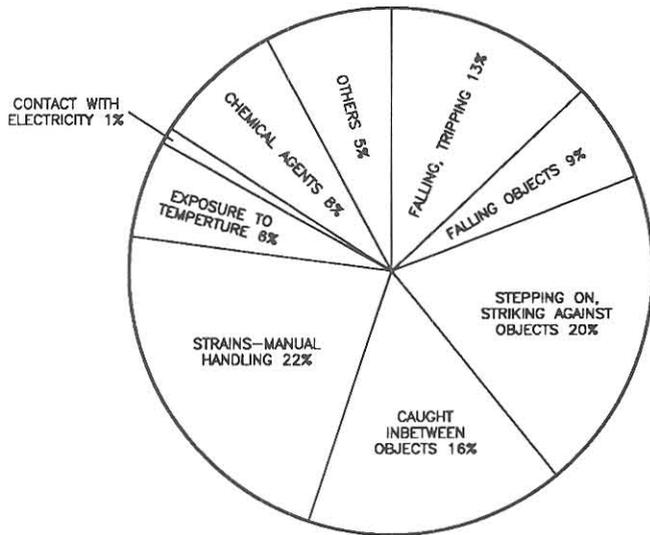
Accidents of 1–3 working days lost time = 35% of accidents

Accidents of 4–10 working days lost time = 37% of accidents

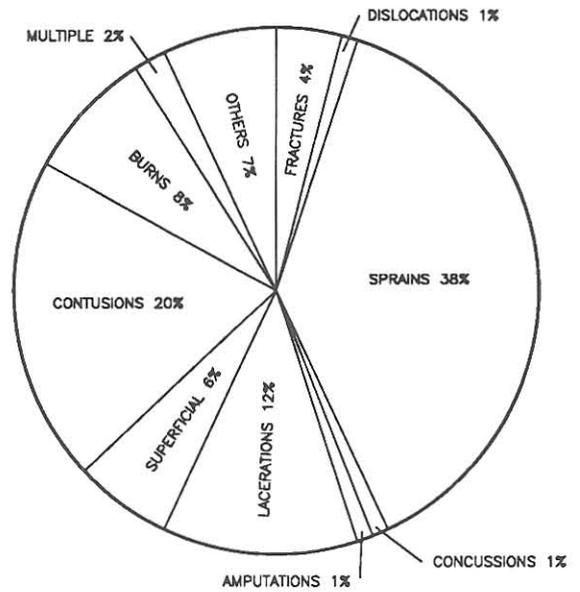
Accidents of over 10 working days lost time = 28% of accidents

MINE INJURY CLASSIFICATION, 1989-90

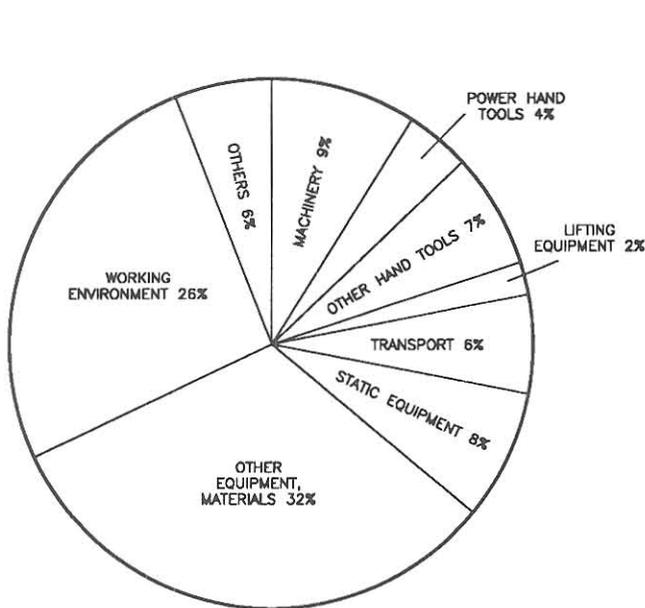
(Australian Standard AS1885)



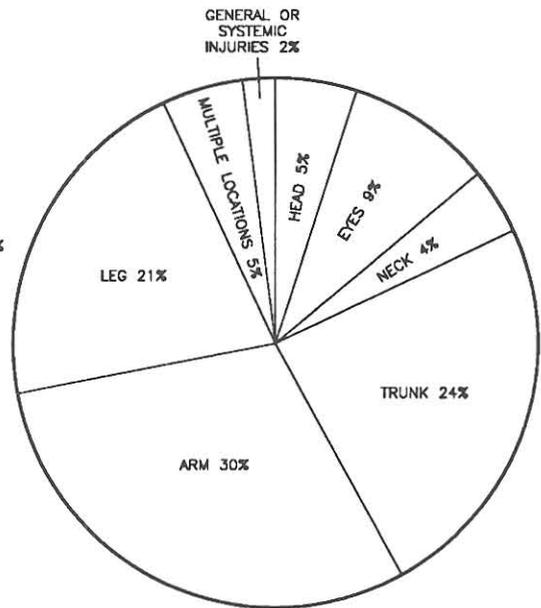
TYPE OF ACCIDENT



NATURE OF INJURY



AGENCY



PART OF BODY INJURED

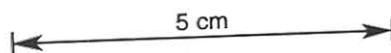


Table 5
CERTIFICATES OF COMPETENCY

The following Certificates of Competency were issued by the Board of Examiners in accordance with the Mines Inspection Act 1968:

MINE MANAGERS CERTIFICATES

<i>Certificate Number</i>	<i>Name</i>	<i>Date</i>	<i>Mine</i>
<i>Metalliferous</i>			
325/89	Neal Roger Valk	4. 9.89	Mt Lyell
326/89	Colin David Patterson	4. 9.89	Renison
327/89	Lee Omero Rossetti	16. 3.90	Mt Lyell
328/90	Allan Earl	20. 4.90	Mt Lyell
<i>Restricted</i>			
R10/90	Lee Omero Rossetti	2. 1.90	Mt Lyell
R11/90	John Arthur Francis Rose	23. 7.90	HEC

Unrestricted certificates were issued following written examinations in legal knowledge and examination *viva voce*.

In addition 108 crane drivers, four winder drivers, and two stationary engine drivers Certificates of Competency were issued.

Table 6
MINERAL PRODUCTION FOR THE YEAR 1989–1990 FROM TASMANIAN SOURCES

	<i>Spectrum Resources</i>	<i>Cornwall Coal Co.</i>	<i>Pasminco Metals (1)</i>	<i>King Is. Scheelite</i>	<i>Mt Lyell</i>	<i>Hellyer</i>	<i>Renison Ltd</i>	<i>Savage Riv. Mines</i>	<i>Pioneer Silicon Ind.</i>	<i>Tasmania Mines</i>	<i>Small Producers</i>
Cadmium (tonnes)	138	...	...	...	...	...	...	...	...
Cobalt oxide (tonnes)	0.58	...	...	...	...	...	...	...	...
Copper (tonnes)	3 795	...	15 933	318	...	...	...	...	...
Gold (kg)	1 124	...	377	...	...	...	...	...	25.07
Iron ore pellets (tonnes)	2 260 774	...	...	...
Lead (tonnes)	27 177	...	...	33 570	...	...	...	...	...
Magnetite (tonnes)	100 761	...	77 588	...
Manganese dioxide (tonnes)	—
Molybdenum (tonnes)	11.98	...	...	...	...	...	...	...
Silicon (tonnes)	9 749	...	...
Silver (kg)	67 449	...	1 998	69 415	...	...	...	...	0.2
Sulphuric acid (mono tonnes)	91 115	...	...	...	...	...	...	...	...
Tin (tonnes)	58	...	...	...	...	...	7 839	...	...	...	6.02
Tungsten (tonnes)	1 191	...	...	...	...	...	338	2.80
Zinc (tonnes)	71 756	...	...	78 657	...	...	...	...	...
Coal (tonnes)	...	545 200	...	...	...	...	...	...	...	...	23 973
Peat (m ³)	1 367

(1) Includes production from Que River Mines

Table 7
VALUE OF THE MINERAL INDUSTRY

<i>Year ended Commodity</i>	<i>Unit</i>	<i>30 June 1989 Total Quantity</i>	<i>30 June 1990 Total Quantity</i>
METALLIC MINERALS			
Cadmium	(tonne)	125	137.7
Cobalt oxide	(tonne)	1.6	1.01
Copper	(tonne)	22 286	20 045
Crocoite	(kilogram)	1 350	-
Gold	(kilogram)	1 972	1 627
Iron ore pellets	(tonne)	2 295 321	2 260 774
Iron oxide	(tonne)	200 354	178 349
Lead	(tonne)	45 649	67 020
Manganese dioxide	(tonne)	135	-
Molybdenum	(tonne)	11	12
Osmiridium	(kilogram)	0.1	-
Pyrite	(tonne)	41 390	34 927
Silica for silicon alloy	(tonne)	149 928	149 746
Silicon (metallic or as alloy)	(tonne)	8 024	9 749
Silver	(kilogram)	120 039	154 369
Tin	(tonne)	6 821	7 903
Tungsten as tungstic oxide	(tonne)	1 764	1 531
Zinc	(tonne)	166 602	150 413
Value of metallic minerals		\$533 274 264	\$556 010 357
NON-METALLIC AND FUEL MINERALS			
Clay-			
Brick	(tonne)	71 242	65 313
Other	(tonne)	61 916	64 042
Kaolin	(tonne)	30 227	31 865
Dolomite	(tonne)	37 878	35 618
Limestone-			
Agricultural	(tonne)	78 113	116 448
Cement	(tonne)	687 045	731 915
Chemical and metallurgical	(tonne)	100 684	65 037
Other	(tonne)	54 583	49 765
Pebbles	(tonne)	-	-
Sulphuric acid	(mono tonne)	66 441	91 115
Coal (run of mine)	(tonne)	632 375	569 173
Peat	(m ³)	3 205	1 367
Value of non-metallic and fuel minerals		\$30 639 949	\$38 629 103
CONSTRUCTION MATERIALS			
Building stone-			
Freestone	(tonne)	155	346
Granite	(tonne)	163	85
Other	(tonne)	688	255
Crushed and broken stone-			
Basalt	(tonne)	1 104 434	1 078 022
Dolerite	(tonne)	1 177 758	1 173 225
Limestone	(tonne)	77 139	55 428
Sandstone	(tonne)	5 568	961
Other	(tonne)	160 013	117 077
Gravel	(tonne)	106 915	90 753
Sand	(tonne)	518 102	498 238
Other road materials	(tonne)	1 312 965	936 798
Value of construction materials		\$24 335 795	\$25 658 351
TOTAL VALUE WITH AUSTRALIAN METAL PRICES			
		\$588 250 008	\$620 297 811
METALLURGICAL PRODUCTION FROM OTHER THAN TASMANIAN ORES			
Aluminium	(.)		
Aluminium sulphate	(.)		
Cadmium	(.)		
Cobalt oxide	(.)		
Ferro-manganese	(.)		
Ferro-silicon	(.)	\$818 298 264	\$739 044 342
Silico-manganese	(.)		
Sinter	(.)		
Superphosphate	(.)		
Titanium dioxide	(.)		
Zinc	(.)		
VALUE OF MINING AND METALLURGICAL PRODUCTION			
		\$1 406 548 272	\$1 359 342 153
REPORTED AVERAGE NUMBER OF EMPLOYEES (1)			
		7 770	6 897

(1) Not all operators report full details

Table 8

**MINERAL PRODUCTION FROM TASMANIAN SOURCES SINCE 1880
QUANTITY OF PRODUCTION AS AT 30 JUNE 1990**

<i>Commodity</i>	<i>Unit</i>	<i>Quantity in Current Year</i>	<i>Total Quantity</i>
METALLIC MINERALS			
Antimony	(tonne)	-	3
Bismuth	(kilogram)	-	110 080
Cadmium	(tonne)	138	4 565
Chromite	(tonne)	-	2 687
Cobalt oxide	(tonne)	1.01	165.3
Copper (blister) to 1918 (now shown under Silver and Copper)	(tonne)	-	169 273
Copper matte	(tonne)	-	6 326
Copper ore to 1918 (now shown under Copper)	(tonne)	-	42 439
Copper (from 1919)	(tonne)	20 045	1 025 361
Crocoite	(kilogram)	-	1 350
Gold	(kilogram)	1 627	120 396
Ilmenite	(tonne)	-	558
Iron ore pellets	(tonne)	2 260 774	47 455 782
Iron oxide (including hematite, limonite and magnetite)	(tonne)	178 349	752 914
Lead (from 1919)	(tonne)	67 020	875 099
Manganese	(tonne)	-	1
Manganese dioxide (from 1957)	(tonne)	-	13 521
Mercury	(kilogram)	-	7 697
Molybdenum	(tonne)	12	159
Monazite	(tonne)	-	34
Nickel	(tonne)	-	237
Osmiridium	(kilogram)	-	881
Pyrite (to 1971)	(tonne)	-	2 124 070
Pyrite (from 1972)	(tonne)	34 927	1 601 292
Rutile	(tonne)	-	1
Rutile (concentrates)	(tonne)	-	40 027
Scheelite (concentrates)	(tonne)	-	57 261
Silica for silicon alloy production	(tonne)	149 746	854 682
Silicon	(tonne)	9 749	25 301
Silver-lead ore to 1918 (now shown under Silver and Lead)	(tonne)	-	1 101 295
Silver (from 1919)	(kilogram)	154 369	3 141 231
Tin	(tonne)	7 903	289 815
Tungsten (as tungstic oxide)	(tonne)	1 531	33 974
Zinc	(tonne)	150 413	2 388 362
Zinc sulphate (from 1957)	(tonne)	-	4 306
Zircon (concentrates)	(tonne)	-	39 001
NON-METALLIC MINERALS			
Asbestos	(tonne)	-	4 044
Barite	(tonne)	-	2 240
Clay (from 1958)	(tonne)	129 355	4 165 301
Dolomite	(tonne)	35 618	309 765
Graphite	(tonne)	-	41
Kaolin	(tonne)	31 865	400 134
Limestone-			
Agricultural and other	(tonne)	166 213	2 330 954
Carbide	(tonne)	-	1 081 509
Cement	(tonne)	731 915	17 064 214
Chemical and metallurgical	(tonne)	65 037	6 101 449
Ochre	(tonne)	-	2 949
Pebbles (from 1957)	(tonne)	-	31 757
Sulphuric acid	(mono tonne)	91 115	5 173 407
Sand (moulding)	(tonne)	-	864
Silica	(tonne)	-	701 248
Talc	(tonne)	-	338

Table 8

MINERAL PRODUCTION FROM TASMANIAN SOURCES SINCE 1880
QUANTITY OF PRODUCTION AS AT 30 JUNE 1990 (continued)

<i>Commodity</i>	<i>Unit</i>	<i>Quantity in Current Year</i>	<i>Total Quantity</i>
FUEL MINERALS			
Coal (run of mine)	(tonne)	569 173	16 770 026
Shale	(tonne)	-	42 239
Peat	(m ³)	1 367	23 927
CONSTRUCTION MATERIALS			
Building stone—			
Freestone	(tonne)	346	29 284
Granite	(tonne)	85	131 921
Other stone	(tonne)	255	38 094
Crushed and broken stone (from 1958)—			
Basalt	(tonne)	1 078 022	15 847 591
Dolerite	(tonne)	1 173 225	27 802 687
Limestone	(tonne)	55 428	1 018 242
Sandstone	(tonne)	961	277 720
Other	(tonne)	117 077	10 771 309
Gravel (from 1958)	(tonne)	90 753	48 197 641
Sand (from 1958)	(tonne)	498 238	8 156 270
Other road-making material	(tonne)	936 798	9 619 732

Table 9

IMPORTED ORES, 1989–90

<i>Company</i>	<i>Product (tonnes)</i>				
	<i>Alumina</i>	<i>Lead-zinc concentrate</i>	<i>Ilmenite</i>	<i>Manganese ore</i>	<i>Phosphate rock</i>
Comalco (Bell Bay)	232 968	...	...	...	...
Pasminco Metals EZ .....	...	291 507	...	...	47 279
Tioxide Australia .....	...	...	69 633	...	...
TEMCO .....	...	...	...	526 324	...

Table 10

NUMBER AND AREA OF LEASES AND LICENCES APPLIED FOR
DURING THE YEAR TO 30 JUNE 1990

<i>Product</i>	<i>Number</i>	<i>Area (ha)</i>	<i>Sluiceways</i>
All minerals	9	2 321	-
Coal	3	305	-
Gemstones.....	1	8	-
Gold	5	269	-
Granite.....	1	3	-
Gravel	13	186	-
Magnesite, silica and talc.....	1	29	-
Ochre and magnesite	2	200	-
Sand	5	97	-
Sand and gravel	4	245	-
Sand, gravel and silica	1	9	-
Shale.....	1	4	-
Silica.....	2	41	-
Slate.....	1	44	-
Slate and shale.....	1	37	-
Stone	35	520	-
Stone and gravel	2	174	-
Tin	2	318	-
Easements	2	31	-
Water	-	-	-
	91	4 941	0

Table 11

NUMBER AND AREA OF NEW LEASES AND LICENCES GRANTED
DURING THE YEAR TO 30 JUNE 1990

<i>Product</i>	<i>Number</i>	<i>Area (ha)</i>	<i>Sluiceways</i>
All minerals	2	1 607	-
Gold	7	594	-
Gravel	12	198	-
Gravel and stone.....	1	3	-
Magnesite, silica and talc.....	1	29	-
Sand	6	196	-
Sand and gravel	2	142	-
Sand and stone.....	1	12	-
Silica.....	2	177	-
Silver and lead.....	1	16	-
Slate.....	2	64	-
Slate and shale.....	1	37	-
Stone	34	545	-
Stone and gravel	1	78	-
Tin	1	235	-
Tin, wolfram and stone.....	1	6	-
Easements	3	10	-
Water	-	-	-
	78	3 949	-

Table 12

TOTAL NUMBER OF LEASES AND LICENCES IN FORCE
ON 30 JUNE 1990

<i>Product</i>	<i>Number</i>	<i>Area (ha)</i>	<i>Sluicheads</i>
All minerals	70	12 610	-
Bauxite	1	53	-
Clay	11	252	-
Coal	14	6 245	-
Copper.....	5	1 276	-
Dolomite.....	2	131	-
Gemstones.....	1	8	-
Gold	71	4 294	-
Granite	6	31	-
Gravel.....	137	3 662	-
Gravel and sand.....	9	839	-
Iron	20	4 399	-
Kaolin.....	3	414	-
Lead and zinc	6	477	-
Limestone	17	1 692	-
Magnesite, silica and talc.....	1	29	-
Ochre and magnesite	2	200	-
Osmiridium	1	1	-
Peat	5	772	-
Sand	67	3 158	-
Sand and stone.....	28	3 577	-
Shale.....	2	5	-
Silica	14	1 433	-
Silica and sand.....	3	178	-
Silver and lead.....	2	24	-
Slate	7	234	-
Specimens	2	16	-
Stone	221	10 222	-
Tin	111	11 342	-
Tin and wolfram	2	9	-
Wolfram	4	84	-
Zinc	1	100	-
Water	39	-	282
Easements	57	583	-
	945	68 073	282

Table 13

TOTAL NUMBER OF ALL TYPES OF PROSPECTING RIGHTS HELD
AS AT 30 JUNE 1990

<i>Mining Tenement</i>	<i>Number</i>	<i>Area</i>
Exploration Licences.....	126	33 269 km ²
Retention Licences	25	530 km ²
Prospectors Licences	39	858 ha
Miners Rights	21	5.25 ha
Owners Rights	5	11 961 ha
Permits to explore for Petroleum under <i>Petroleum (Submerged Lands) Act 1967</i>	6	382 blocks

Table 14

**LICENCES, PERMITS AND APPROVALS ISSUED FOR THE IMPORT,
MANUFACTURE, STORAGE, USE AND SALE OF DANGEROUS
GOODS, 1989/90**

Licences to keep flammable liquids and dangerous goods	2 478
Licences to sell explosives and safety cartridges	167
Private magazine licences	95
Import explosives licences	33
Convey explosives licences	17
Manufacture explosives licences	1
To sell fireworks licences	283
Applications for shotfirers permits	48
Applications for plan approvals	354
Landing permits (fireworks and explosives)	71
Transfers and information retrieval requests.....	113
Manufacture dangerous goods licences	7
Import dangerous goods licences	17
Gas suppliers licences	2
Exemptions	-

Table 15

IMPORTS OF FLAMMABLE LIQUIDS, 1989/90

<i>Product (tonnes)</i>	<i>Bell Bay</i>	<i>Burnie</i>	<i>Devonport</i>	<i>Hobart</i>	<i>Total</i>
Aviation gasoline	2 228	-	-	-	2 228
LP gas	7 187	-	16 694	10 050	33 931
Unleaded petrol	11 194	10 207	16 290	28 684	66 375
Super petrol	35 524	27 242	53 451	121 260	237 477
Kerosene-					
Aviation - Jet	10 432	-	-	10 198	20 630
Lighting and power	-	-	-	-	-
Bitumen feed stock	-	2 053	3 004	21 414	26 471
AGO and distillate	38 498	37 053	50 200	84 599	210 350
Heating and fuel oil	2 762	2 401	7 355	6 432	18 950
Total (tonnes) per port	107 825	78 956	146 994	282 637	616 412
Number of tankerships	29	10	29	32	100

Table 16

IMPORTS OF EXPLOSIVES, 1989/90

<i>Product (cartons)</i>		<i>Burnie</i>	<i>King Island</i>	<i>Devonport</i>	<i>Total</i>
Blasting Explosives	1.1D	38 602	180	312	39 094
Propellant Powder	1.1C	-	-	2	2
Detonators	1.1B	3 042	135	-	3 177
Detonators	1.4B	157	-	-	157
Total (cartons)		41 801	315	314	42 430
Number of shipments		30	20	3	53

No explosives were imported through Strahan, Hobart, Queenstown, Bell Bay, Wynyard or Smithton in 1989/90. Shipments through King Island were by aircraft.

Table 17**ACTS ADMINISTERED BY THE DIVISION
OF MINES & MINERAL RESOURCES**

Aid to Mining Act 1927
 Dangerous Goods Act 1976
 Department of Mines (Investigations) Act 1972
 Director of Mines Act 1951
 Gas Franchises Act 1973
 Groundwater Act 1985
 Iron Ore (Savage River) Agreement Act 1965
 Mineral Resources Act 1951
 Mines Inspection 1968
 Mining Acts 1929 and 1958
 Mount Cameron Water-Race Act 1926
 Mount Read and Rosebery Mines Limited Leases Act 1916
 Petroleum (Submerged Lands) Acts 1967, 1982

Table 18**STAFF EMPLOYMENT AS AT 30 JUNE 1990**

Administration	27
Mines Inspection	22
Dangerous Goods	9
Geological Survey	44
Chemical & Metallurgical	15
R.D. and P.P.	13
Others	13
Total	143

Table 19
DRILLING DETAILS 1989-90

<i>Location</i>	<i>Purpose</i>	<i>Drill</i>	<i>No. of Holes</i>	<i>Total depth (m)</i>
DIAMOND DRILLING				
Lisle	Stratigraphic investigation	Longyear 38/2	2	214.4
Cradle Mountain Link Road	Stratigraphic investigation	Longyear 44/1	1	175.7
Melba Flats	Stratigraphic investigation	Longyear 44/2	1	144.1
Miners Ridge	Stratigraphic investigation	Longyear 44/2	1	938.0
Mt Cattley	Stratigraphic investigation	Warman 1000	1	138.3
Corinna	Stratigraphic investigation	Warman 1000	2	156.8
Cape Sorell	Stratigraphic investigation	Longyear 44/1	2	290.0
Mt Cattley	Stratigraphic investigation	Longyear 44/1	1	518.0
Pelverata	Mineral contract	Longyear 38/2	3	52.4
Zeehan	Site investigation	Longyear 44/2	2	98.1
Grassy Wharf	Site investigation	Longyear 38/2	5	80.1
	Sub-Total		21	2 805.9
ROTARY/DOWN HOLE HAMMER DRILLING				
Upper Castra	Groundwater investigation	Warman 1000	2	140
Sheffield	Groundwater investigation	Warman 1000	3	307
Spreyton	Groundwater investigation	Warman 1000	1	63
Wynyard	Groundwater investigation	Warman 1000	1	90
Trowutta	Groundwater investigation	Warman 1000	1	80
Togarai	Groundwater investigation	Warman 1000	4	148
Scopus	Groundwater investigation	Warman 1000	1	33
South Forest	Groundwater investigation	Warman 1000	1	80
Burnie Tip	Site investigation	Warman 1000	6	300
Craigow	Contract	Gemco A	30	30
	Sub-Total		50	1 271
CHURN DRILLING				
Ringarooma	Mineral contract	Keystone	3	23.5
DIAMOND/AUGER DRILLING				
Hadspen	Bridge investigation	Gemco 210D	5	64.1
Cooee	Road investigation	Gemco 210D	7	237.3
Exeter Tip	Site investigation	Gemco 210D	3	88.5
Triabunna	Transformer earthing	Gemco 210D	2	12
Cooee, Cam River	Bridge investigation	Gemco 210D	8	217.9
Victoria Bridge, Devonport	Bridge investigation	Gemco 210D	17	287.3
Glenorchy, Hone Road	Landslip investigation	Gemco 210D	5	105.5
Richmond	Site investigation	Gemco 210D	1	13.2
Trafalgar Place	Site investigation	Gemco A	1	10
	Sub-Total		49	1 035.8
	Total		123	5 136.2

Table 20

TYPE AND NUMBER OF TESTS,
CHEMICAL AND METALLURGICAL DIVISION

I. QUANTITATIVE	
A. Elements	
Aluminium (Al)	240
Aluminium (Al ₂ O ₃)	810
Antimony	310
Arsenic	1 151
Barium	466
Beryllium	2
Bismuth	477
Boron	9
Bromine	9
Cadmium	815
Calcium (Ca)	314
Calcium (CaO)	759
Carbon	18
Cerium	374
Chlorine	727
Chromium	798
Cobalt	463
Copper	1 943
Cyanide	7
Fluorine	657
Gallium	359
Gold	1 091
Iridium	-
Iridium	1
Iron (Fe)	1 393
Iron (FeO)	463
Iron (Fe ₂ O ₃)	704
Lanthanum	359
Lead	1 884
Magnesium	506
Magnesium (MgO)	783
Manganese (MnO)	568
Manganese (Mn)	826
Mercury	723
Molybdenum	267
Neodymium	361
Nickel	600
Niobium	422
Nitrogen (as Ammonium)	37
Nitrogen (NO ₃)	72
Phosphorous (P)	166
Phosphorous (P ₂ O ₅)	662
Platinum	12
Potassium (K)	470
Potassium (K ₂ O)	484
Rubidium	422
Scandium	422
Selenium	44
Silicon (SiO ₂)	894
Silver	645
Sodium (Na)	470
Sodium (Na ₂ O)	478
Strontium	443
Sulphur (S)	437
Sulphur (as Sulphide)	9
Sulphur (SO ₃)	459
Sulphur (SO ₄)	780
Tantalum	4
Tellurium	33
Thallium	7
Thorium	443
Tin	975
Titanium (TiO ₂)	615
Tungsten (W)	193
Tungsten (WO ₃)	1 405
Uranium	401
Vanadium	437
Yttrium	437
Zinc (Zn)	1 665

Table 20

TYPE AND NUMBER OF TESTS, CHEMICAL AND METALLURGICAL DIVISION — *continued*

Zinc (ZnO)	18		
Zirconium (Zr)	461		
Zirconium (ZrO ₂)	36	<u>36</u>	195
B. Miscellaneous—Waters			
Conductivity	575		
Dissolved solids	501		
Suspended solids	549		
Turbidity	64		
pH	929		
Alkalinity	322		
Permanent hardness	218		
Temporary hardness	218		
Dissolved oxygen	71		
Carbonate	231		
Bicarbonate	231		
Hydroxyl ion	-		
Silica	7	<u>3</u>	916
C. Other			
Specific gravity	2		
Free Cyanide	31		
Specific energy	6		
Acid insolubles	9		
Acid soluble iron	80		
VCM	2		
Combined water	472		
Loss on Ignition	659		
Ash	24		
CO ₂	335	<u>1</u>	620
II. QUALITATIVE		<u>6</u>	798
III. METALLURGICAL			
Sizing analysis	45		
Magnetic separation	43		
Panning	17		
Cyanidation	99		
Screening operation	129		
Jigging	112		
Tabling	157		
Gold smelting	3		
Specific Gravity	84		
Flotation	5		
Roasting/Ashing	25		
Heavy Liquid Separation	221		
Cyclosizing	17		
Settling tests	2		
Crushing and grinding	5		
Drying	9		
Amalgamation	1		
Retorting	1		
Pulp density	2		
Pulping and decantation	12	<u>9</u>	89
Total			42 787