

**ROSS MINING N.L**

**A.C.N. 006 654 824**

**SPRING HILL PROJECT  
NORTHERN TERRITORY**

**REPORT ON WORK COMPLETED  
FOR THE CURRENT PERIOD  
OF TENURE TO ACCOMPANY  
APPLICATION FOR RENEWAL  
OF MCN's 130, 142, 176, 178,  
187, 229, 318, 420, 421, 422, 509,  
597, 677, 742, 752, 4033-4052,  
4054, 4057-4066, 4195, 4196  
AND MLN's 801-803**

**DISTRIBUTION:**

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## PREFACE

This report serves to relate the exploration and feasibility activities carried out upon 51 mineral tenements which comprise 67% of the area of the Spring Hill Project. The current terms of tenure of the 48 MCNs and 3 MLNs are all due to expire in 1996 as shown in Table 1. This report, however, addresses the project as a whole, as do the current activities.

Aside from the exploration history summarised herein and planned further evaluation of currently sub-economic zones of mineralisation, the current and proposed activities pertain to ongoing feasibility studies. As these studies transgress across tenement boundaries it is requested that this report be acceptable for the renewal purposes of the individual 51 tenements.

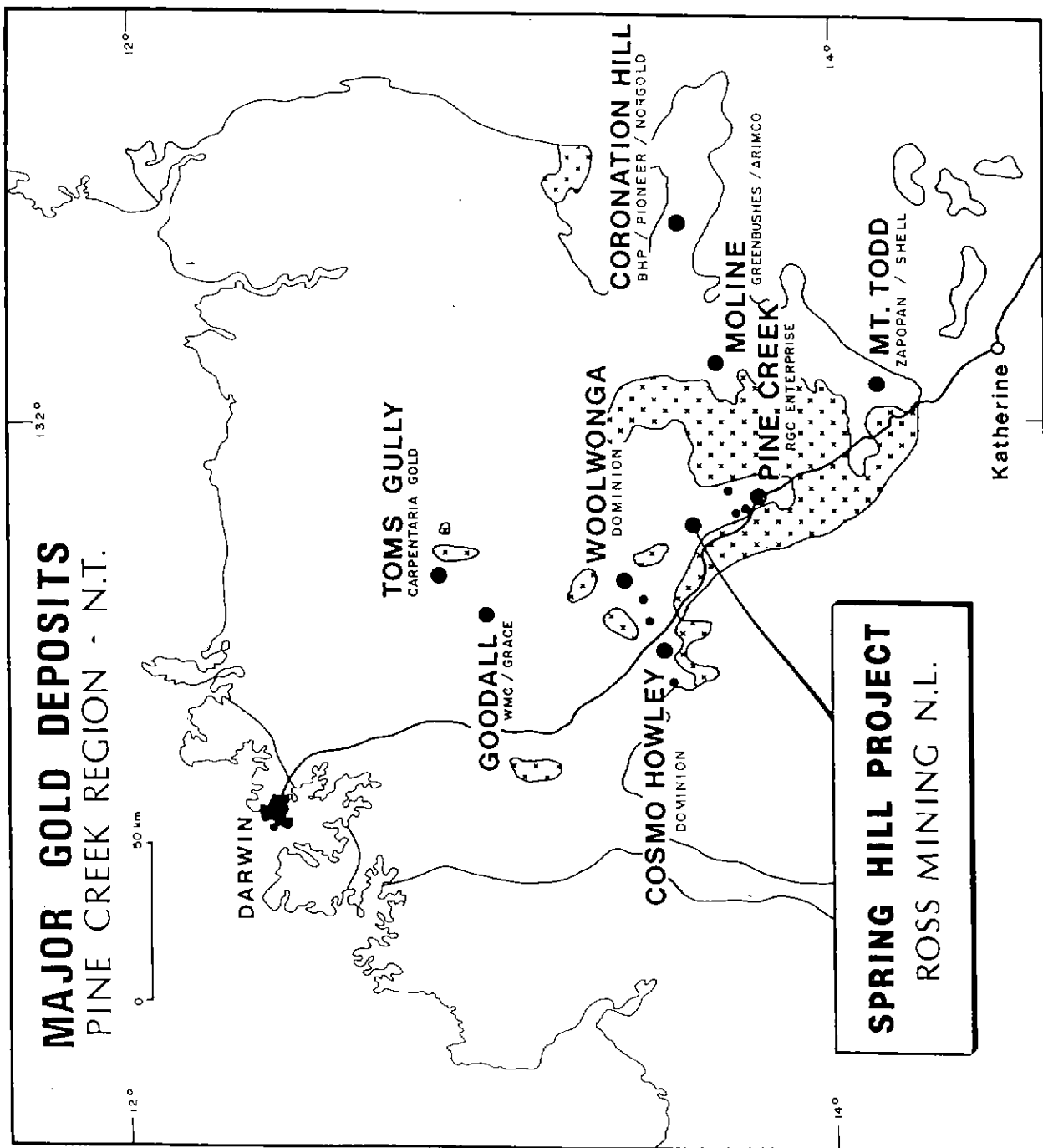


Figure 1

## 1.0 INTRODUCTION

The Spring Hill Project is approximately 150 kilometres south of Darwin in the Northern Territory (Figure 1). The prospect is situated approximately 27 kilometres north-northwest of the township of Pine Creek and is accessed via the Stuart Highway, then along the unsealed Spring Hill Road.

The tenements which comprise the Spring Hill Project consist of 48 MCN's and 3 MLN's (Table 1). They have a total area of 971 hectares and cover 67% of the project area. These tenements are highlighted in various colours corresponding to their renewal date in Figure 2.

The project area is located in the southern part of the Pine Creek Geosyncline, which consists of Early Proterozoic metasedimentary rocks overlying a gneissic and granitic Archaean basement. A regional shear zone, the Pine Creek Shear, extends from Pine Creek in the south and passes immediately east of the Spring Hill area. The Pine Creek Shear has been a major focus for the passage of gold-bearing fluids and is spatially related to the majority of gold occurrences in the Pine Creek Geosyncline.

Historically, high-grade lodes at Spring Hill were mined in the early part of this century. More recently the tenements have been the subject of extensive exploration by Territory Resources NL, Billiton Australia ("Billiton"), and Ross Mining NL ("Ross Mining") for bulk tonnage-low grade gold deposits.

Gold mineralisation at Spring Hill is typical of the Pine Creek Geosyncline being situated on the western limb of an anticline. Mineralisation is mostly present as sheeted veins that form regular and often extensive sheeted systems such as the Hong Kong zone. Anticline-related tension fill veins, bedding parallel veins, and saddle reefs are less common but comprise a major part of the gold mineralisation in the Main and East lodes.

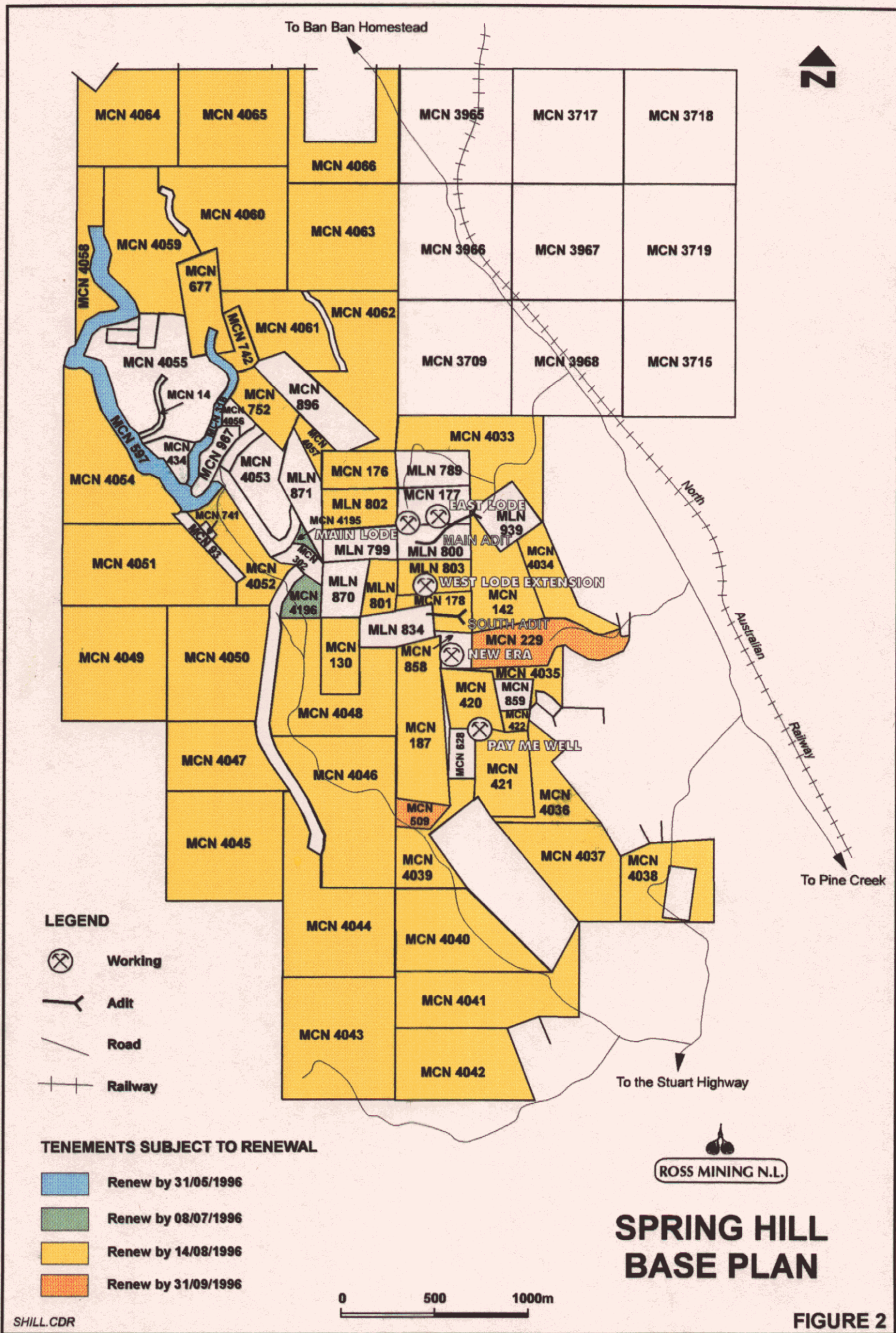
Ross Mining has recently carried out a gold resource estimate using geostatistical block modeling (see Appendix 2 of this report). The global gold resource at Spring Hill was estimated using full indicator kriging. The total gold resource including dump leach material at Spring Hill is 12.75 Mt @ 0.80 g/t Au, contained gold being 328,000 ozs.

Direct exploration costs by the Billiton/Ross Mining joint venture and the subsequent ongoing expenditure by Ross Mining on the project has totalled \$4.15 million. This covers the period from inception of the joint venture in 1988 up to the end of 1995. Acquisition costs which have resulted in Ross Mining's 100 per cent control of the project have been \$2.51 million.

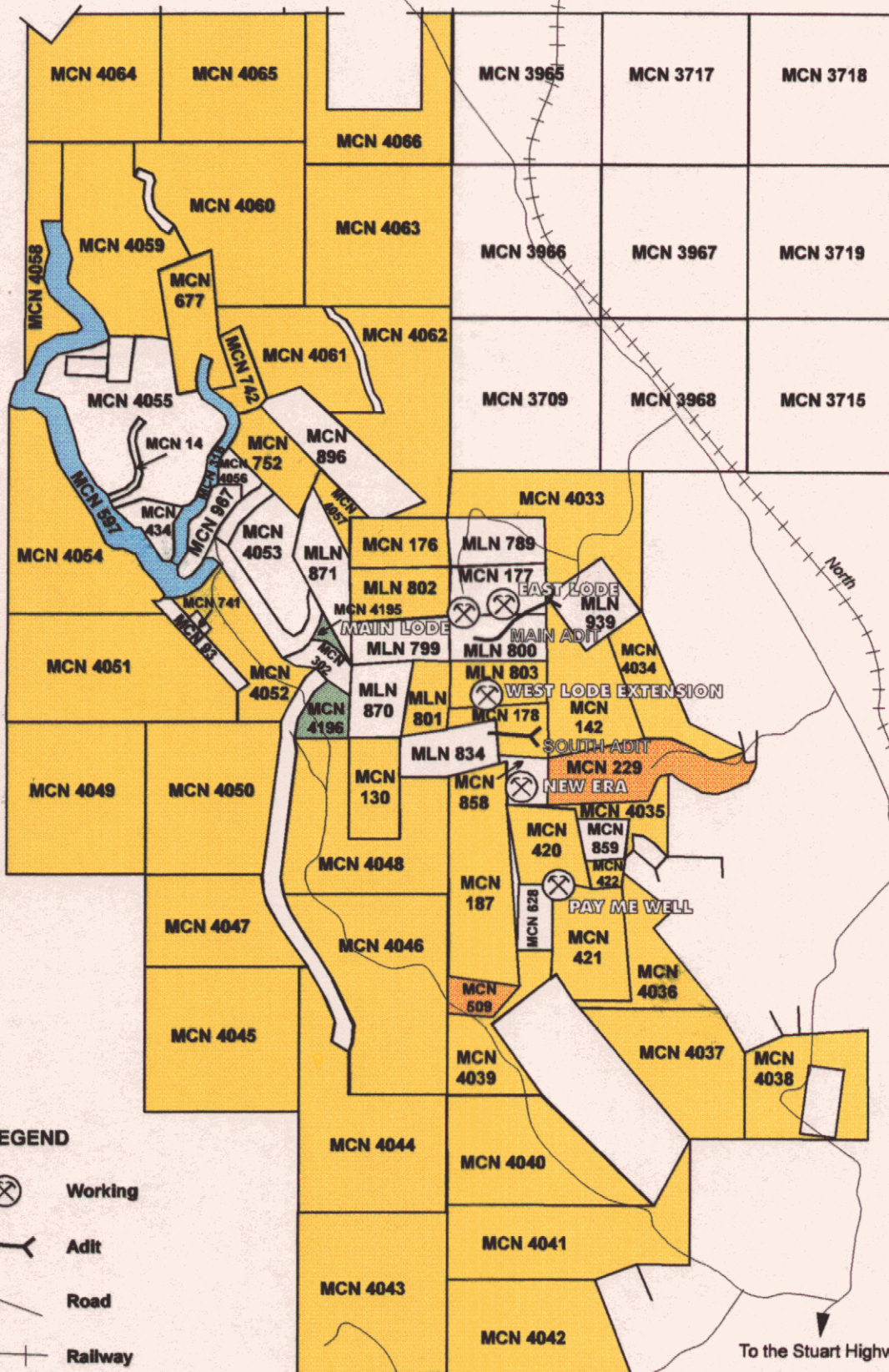
TABLE 1 - SPRING HILL TENEMENT RENEWALS DUE IN 1996

Tenement Type	Tenement Nos	Tenement Name	Company	Expiry Date	Area (Hectares)	Totals
MCN	318	Spring Hill	Ross Mining	31-Aug-96	4	
MCN	597	Spring Hill	Ross Mining	31-Aug-96	16	
MCN	4195	Spring Hill	Ross Mining	08-Oct-96	1	
MCN	4196	Spring Hill	Ross Mining	08-Oct-96	4	
MCN	130	Spring Hill	Ross Mining	14-Nov-96	9	
MCN	142	Spring Hill	Ross Mining	14-Nov-96	9	
MCN	176	Spring Hill	Ross Mining	14-Nov-96	9	
MCN	178	Spring Hill	Ross Mining	14-Nov-96	6	
MCN	187	Spring Hill	Ross Mining	14-Nov-96	27	
MCN	420	Spring Hill	Ross Mining	14-Nov-96	7	
MCN	421	Spring Hill	Ross Mining	14-Nov-96	12	
MCN	422	Spring Hill	Ross Mining	14-Nov-96	2	
MCN	677	Spring Hill	Ross Mining	14-Nov-96	8	
MCN	742	Spring Hill	Ross Mining	14-Nov-96	4	
MCN	752	Spring Hill	Ross Mining	14-Nov-96	8	
MCN	4033	Spring Hill	Ross Mining	14-Nov-96	28	
MCN	4034	Spring Hill	Ross Mining	14-Nov-96	13	
MCN	4035	Spring Hill	Ross Mining	14-Nov-96	4	
MCN	4036	Spring Hill	Ross Mining	14-Nov-96	11	
MCN	4037	Spring Hill	Ross Mining	14-Nov-96	23	
MCN	4038	Spring Hill	Ross Mining	14-Nov-96	18	
MCN	4039	Spring Hill	Ross Mining	14-Nov-96	12	
MCN	4040	Spring Hill	Ross Mining	14-Nov-96	24	
MCN	4041	Spring Hill	Ross Mining	14-Nov-96	36	
MCN	4042	Spring Hill	Ross Mining	14-Nov-96	26	
MCN	4043	Spring Hill	Ross Mining	14-Nov-96	39	
MCN	4044	Spring Hill	Ross Mining	14-Nov-96	37	
MCN	4045	Spring Hill	Ross Mining	14-Nov-96	36	
MCN	4046	Spring Hill	Ross Mining	14-Nov-96	38	
MCN	4047	Spring Hill	Ross Mining	14-Nov-96	21	
MCN	4048	Spring Hill	Ross Mining	14-Nov-96	30	
MCN	4049	Spring Hill	Ross Mining	14-Nov-96	35	
MCN	4050	Spring Hill	Ross Mining	14-Nov-96	31	
MCN	4051	Spring Hill	Ross Mining	14-Nov-96	35	
MCN	4052	Spring Hill	Ross Mining	14-Nov-96	14	
MCN	4054	Spring Hill	Ross Mining	14-Nov-96	31	
MCN	4057	Spring Hill	Ross Mining	14-Nov-96	3	
MCN	4058	Spring Hill	Ross Mining	14-Nov-96	15	
MCN	4059	Spring Hill	Ross Mining	14-Nov-96	29	
MCN	4060	Spring Hill	Ross Mining	14-Nov-96	33	
MCN	4061	Spring Hill	Ross Mining	14-Nov-96	15	
MCN	4062	Spring Hill	Ross Mining	14-Nov-96	29	
MCN	4063	Spring Hill	Ross Mining	14-Nov-96	35	
MCN	4064	Spring Hill	Ross Mining	14-Nov-96	26	
MCN	4065	Spring Hill	Ross Mining	14-Nov-96	32	
MCN	4066	Spring Hill	Ross Mining	14-Nov-96	21	
MCN	229	Spring Hill	Ross Mining	31-Dec-96	34	
MCN	509	Spring Hill	Ross Mining	31-Dec-96	4	
						944
MLN	801	Spring Hill	Ross Mining	14-Nov-96	9	
MLN	802	Spring Hill	Ross Mining	14-Nov-96	9	
MLN	803	Spring Hill	Ross Mining	14-Nov-96	9	
						27
Total Hectare						971





To Ban Ban Homestead



North

Australian

Railway

To Pine Creek

To the Stuart Highway



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# SPRING HILL BASE PLAN

## 2.0 REGIONAL GEOLOGY

The Spring Hill area is located in the southern part of the Pine Creek Geosyncline which contains Early Proterozoic metasedimentary rocks resting on a gneissic and granitic Archaean basement. The geosynclinal sequence is dominated by mudstones, siltstones, greywackes, sandstones, tuffs, and limestones. The Pine Creek Geosyncline was folded and metamorphosed up to the amphibolite facies from  $\pm 1870 - 1899$  Ma. Transitional igneous rocks, including pre-tectonic dolerite sills and syn- to post-tectonic granitoid plutons and dolerite lopoliths and dykes, intrude the geosynclinal sequence. Detailed geology of the Pine Creek Geosyncline is discussed by Nicholson, Ormsby, and Farrar (1994).

Stratigraphy in the central Pine Creek Geosyncline has been simplified by Nicholson, Ormsby, and Farrar (1994) into the Batchelor, Frances Creek, and Finnis River Groups. The Batchelor Group consists of shallow water coarse clastics and crystalline carbonates that are conformably overlain by the Frances Creek Group. The Frances Creek Group is subdivided into the Whites Formation, Acacia Gap Quartzite / Mundogie Sandstone, Koolpin Formation, Gerowie Tuff, and Mount Bonnie Formation. The Gerowie Tuff is a basin-wide mudstone-rich sequence with interbeds of diagenetically altered distal tuff which is overlain by greywacke, mudstone, chert, and ironstone of the Mount Bonnie Formation. The Finnis River Group overlies the Frances Creek Group and consists of a thick flysch sequence of greywacke and mudstone.

Two major phases of deformation that pre-date granitoid intrusions have been recognised in the Pine Creek Geosyncline. The earliest widely recognised structures in the Pine Creek Geosyncline are bedding-concordant fabrics and breccia zones ( $D_1$ ). The second phase of deformation produced the north to north-west trending folds dominant today ( $D_2$ ). The folds vary from open and upright to overturned and isoclinal, and were accompanied by the development of a penetrative slaty cleavage.

The Pine Creek Fault Zone is a 300 km long structure that can be mapped from Darwin to Katherine. The fault zone trends north-northwest and consists of a number of sub-parallel faults, over a 5 km corridor, with apparent sinistral movement of up to 2 km. The Pine Creek Fault Zone postdates  $D_2$  and the granite intrusions.



### 3.0 SPRING HILL GEOLOGY

Both major phases of deformation that pre-date granitoid intrusions are present in Early Proterozoic sedimentary rocks in the Spring Hill area (Melville, 1994). The older phase is represented by tight to isoclinal folds (F1) that trend north to northwest. A major anticlinal fold of this generation, the Spring Hill Anticline, is the dominant structure in the tenements.

All rocks exposed at Spring Hill belong to the Gerowie Tuff, Mount Bonnie Formation, and Burrell Creek Formation. The Mount Bonnie formation hosts all the known significant gold mineralisation and consists dominantly of massive greywacke with minor siltstone interbeds, interbedded silts and shales, and minor chert and laminated iron formations.

Gold mineralisation at Spring Hill has been recognised to occur in quartz veins that are present in several styles. Veining at Spring Hill has been classified into three main types (Sheldon, Scrimgeour, and Edwards; 1994):

1.     Sheeted veins comprising extensive systems of parallel veins
2.     Leader veins, which form individual thicker veins
3.     Bedding parallel veins

Dark brown alteration selvages are commonly associated with veining. The selvages are due to flooding of the wall rock during veining with resulting enrichment Fe and minor K, As, P, and Zn.

Previous mining at Spring Hill was concentrated on the high grade lodes (Main, Eastern, Western, and Anticlinal Lodes). More recently sheeted veins that together comprise low-grade, bulk tonnage targets have been the focus of exploration (Hong Kong sheeted vein system). Refer to Figure 4 of this report.

Detailed geology for the Spring Hill prospect can be found in Melville (1994) and Sheldon, Scrimgeour, and Edwards (1994).

## 4.0 PROGRAM TO DATE

The current group of 80 mineral tenements covers an area previously occupied by Exploration Licences 4793 and 4873. A joint venture between Ross Mining as owner and Billiton as operator commenced over these tenements in October 1988.

During the period up until relinquishment in October 1990, the EL's were subjected to stream sediment sampling and reconnaissance mapping and rock chip sampling. Aeromagnetic coverage was purchased as part of a multi-client survey carried out by Aerodata Holdings. Reference to this work is made in the final reports for these tenements by CR Mackay dated November 1990 for EL 4873 and EL 4793.

An ongoing program from 1988 is in progress, initially on 15 MCN's and 8 MLN's within the then current exploration licences. Further pegging in relinquished areas and the exercising of option agreements with other tenement holders in the project area has produced the current tenement holding.

The work conducted by Billiton up till December 1991 as Ross Mining's joint venture partner is documented in Billiton Australia Report numbers 08.4169 (Hellsten, 1989), 08.5200 (MacKay, 1990) and 08.5793 (MacKay, 1991) as referenced at the end of this report.

During this period Billiton established a grid over the mineralised trend and carried out soil sampling, geological mapping, rock chip sampling, costeaning, diamond and reverse circulation drilling, metallurgical testing, petrological analysis, a TEM survey and structural mapping and modelling.

Billiton Australia undertook five drilling campaigns (Phases I - V) from 1989 to 1991. This included ten diamond core holes (SHDH001-010; 709m) and 88 reverse circulation holes (SHRC001-088; 5322m) for an aggregate 6031m. Five reverse circulation drill holes (SHRC003, SHRC007, SHRC052, SHRC072, SHRC077) were precollars for diamond core drill holes.

In 1993 and 1994 Ross Mining contracted Eupene Exploration Enterprises to carry out further exploration on the Spring Hill tenements under the supervision of Ross Mining.

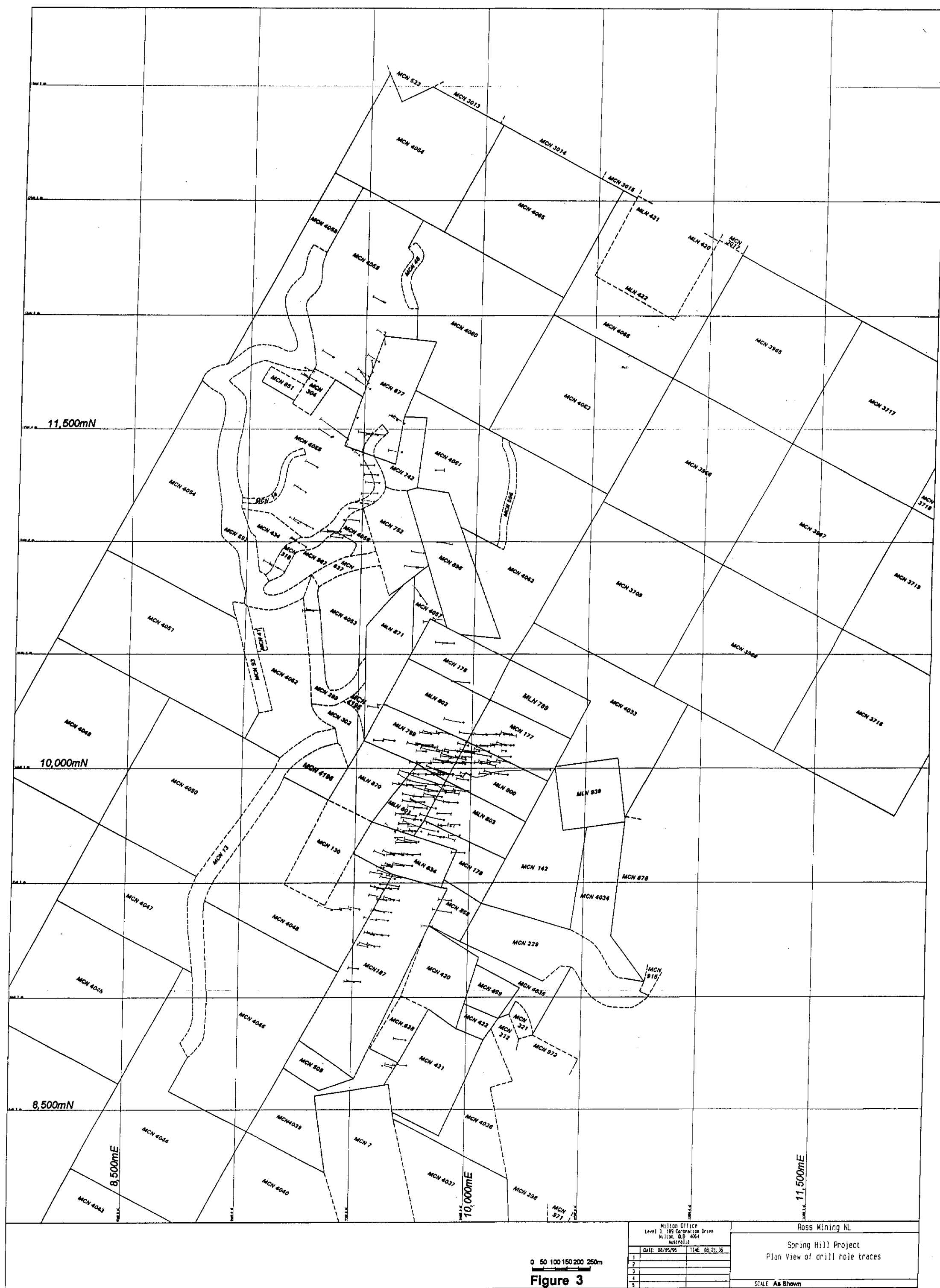
Eupene Exploration's work is documented in the report "Exploration Report for Spring Hill 1994" by T. Sheldon, I. Scrimgeour and D. Edwards. The work involved included re-establishing the 1989 grid, stream sediment sampling along the western side of the project area and grid based soil sampling. A total of 84 reconnaissance, 95 geological and 16 x 25m channel samples were collected.

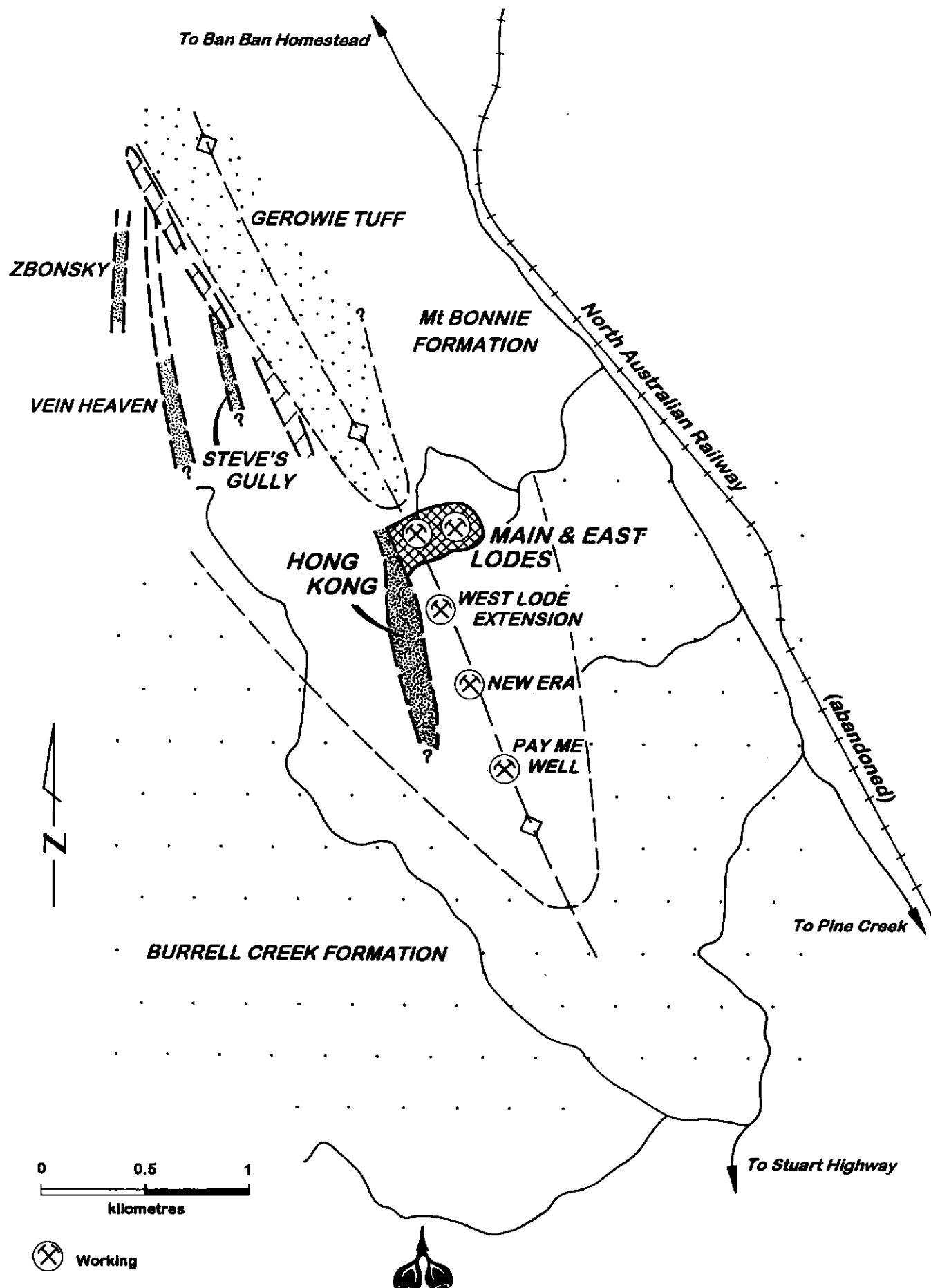
Over this period 267 hectares of surface were geologically mapped at a 1:1000 scale, with 13 rock samples submitted for petrographic analysis.

In the area of old underground workings the Main Adit was reopened to 390 m and the South Adit completely reopened to 140 m (see Figure 2). Mapping and sampling were undertaken along the adits with 343 samples taken.

Three phases of drilling were carried out during this period. In 1993 thirteen reverse circulation holes were drilled (SHRC089-101). These 13 drill holes were all 99m deep for an aggregate of 1287 m.

Exploration in 1994 was carried out in two phases. Phase I involved mostly exploration drilling to extend the resource in the Hong Kong area. Forty-five reverse circulation holes (SHRC102-146) were drilled during this period for an aggregate 6309m. Phase II included infill and twin drilling in the Hong Kong and the Main and East Lode areas, and exploration drilling throughout the Spring Hill tenements including Vein Heaven, Vindication Hill, and Steve's Gully. This phase of drilling included 87 reverse circulation (SHRC147-234; 9051m) and 9 diamond core (SHDH011-019; 949m) for an aggregate 10,000m. Drill hole traces for drilling throughout the project area are shown on Figure 3.





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**SPRING HILL**  
**Generalised Geology**  
**+ Prospect Locations**

Figure 4

## 5.0 CURRENT ACTIVITIES

During 1995 the project moved from pre feasibility water quality monitoring through to environmental investigations metallurgical testwork, resource/reserve estimations and scoping studies.

### 5.1 Metallurgical Testwork

Over the period from February to August 1995 AMMTEC Ltd of Perth carried out test work on a series of mineralised samples which represented the oxide, transition and sulphide zones of various Spring Hill lodes (AMMTEC Ltd, 1995). Half HQ size core from 1994 drill holes were used for the test work and a series of reports produced. The following tables show the samples and drill holes pertaining to each report. Further details on drill core intervals and grade can be found in the 1995 Spring Hill Project Annual Report to NT Department of Mines & Energy.

AMMTEC REPORT No A4473 - PART A

Name of Lode	Met Samp No	From Hole No	Testwork Type	Mineralisation Type
Hong Kong	SHA 01	SHDH 018	Agitation Leaching	Oxide
Hong Kong	SHA 02	SHDH 011	Agitation Leaching	Oxide
Hong Kong	SHA 03	SHDH 011	Agitation Leaching	Oxide
Hong Kong	SHA 04	SHDH 019	Agitation Leaching	Oxide
Hong Kong	SHA 05	SHDH 019	Agitation Leaching	Transition
Hong Kong	SHA 06	SHDH 013	Agitation Leaching	Transition
Hong Kong	SHA 07	SHDH 019	Agitation Leaching	Sulphide
Hong Kong	SHA 08	SHDH 018	Agitation Leaching	Sulphide
Hong Kong	SHA 09	SHDH 012	Agitation Leaching	Sulphide
Hong Kong	SHA 10	SHDH 019	Agitation Leaching	Sulphide
Hong Kong	SHA 12	SHDH 018	Agitation Leaching	Sulphide
Hong Kong	SHA 13	SHDH 012	Agitation Leaching	Sulphide
Main & East	SHA 14	SHDH 016	Agitation Leaching	Oxide
Main & East	SHA 15	SHDH 016	Agitation Leaching	Oxide
Main & East	SHA 16	SHDH 015	Agitation Leaching	Transition
Main & East	SHA 17	SHDH 015	Agitation Leaching	Transition
Main & East	SHA 18	SHDH 015	Agitation Leaching	Sulphide

AMMTEC REPORT No A4473 - PART B

Name of Lode	Met Samp No	From Hole No	Testwork Type	Mineralisation Type
Hong Kong	SHC 01	SHDH 011,018	Column Leaching	Oxide
Hong Kong	SCH 02	SHDH 013, 019	Column Leaching	Transition
Main & East	SCH 03	SHDH 016	Column Leaching	Oxide
Main & East	SCH 04	SHDH 015	Column Leaching	Transition

AMMTEC REPORT Nos A4636 & A4732

Name of Lode	Met Samp No	From Hole No	Testwork Type	Mineralisation Type
Hong Kong	SHC 05	SHDH 018, 019	Column Leaching	Sulphide
Hong Kong	SHC 06	SHDH 012	Column Leaching	Sulphide



The agitation leach tests on the six oxide and four transition zone samples returned between 95% and 99% gold extraction. The seven sulphide samples gave gold recoveries between 80% and 98%.

These tests showed that the gold bearing sulphide mineralisation can be classed as free milling. The column leach tests further determined the leach characteristics of this deeper mineralisation. The results show that unlike the oxide and transition material the sulphide material is not suited to heap leach processing techniques.

## 5.2 Resource Estimation

Following an extensive infill drilling campaign in 1994 a traditional manual polygon on section gold resource was calculated. This estimate outlined a resource of 5.00 Mt @ 1.64 g/t gold for 263 000 oz of contained gold using a 0.7 g/t Au cut-off ( Richmond, March 1995).

To facilitate pit optimisation studies and a provisional mine design, a three dimensional geostatistical block model of gold grades at Spring Hill was generated in September, 1995 (Richmond, September 1995). The global gold resource at Spring Hill was estimated using full indicator kriging. The **gold resource** at Spring Hill is **5.74 Mt @ 1.29 g/t Au using a 0.7 g/t Au cut-off**. If dump leach mining methods are used then the **total gold resource** at Spring Hill for a **0.2 g/t Au cut-off is 12.75 Mt @ 0.80 g/t Au**.

### SPRING HILL GLOBAL GOLD RESOURCE ESTIMATE - 0.7 G/T AU CUT-OFF

RESOURCE ESTIMATE	CATEGORY	AVERAGE GOLD GRADE (g/t)	TONNES (Mt)	CONTAINED GOLD (oz)
Oxide	Indicated + Inferred	1.24	2.37	95 000
Transitional	Indicated + Inferred	1.21	0.89	35 000
Sulphide	Indicated + Inferred	1.35	2.48	108 000
<b>TOTAL</b>	<b>Indicated + Inferred</b>	<b>1.29</b>	<b>5.74</b>	<b>238 000</b>

### SPRING HILL GLOBAL GOLD RESOURCE ESTIMATE - 0.2 to 0.7 G/T AU.

RESOURCE ESTIMATE	CATEGORY	AVERAGE GOLD GRADE (g/t)	TONNES (Mt)	CONTAINED GOLD (oz)
Oxide	Indicated + Inferred	0.40	3.23	41 500
Transitional	Indicated + Inferred	0.39	1.25	15 700
Sulphide	Indicated + Inferred	0.40	2.53	32 500
<b>TOTAL</b>	<b>Indicated + Inferred</b>	<b>0.40</b>	<b>7.01</b>	<b>89 700</b>

Pit optimisation studies will need to be completed using the geostatistical block model generated by Richmond to convert the resources to reserves.

### **5.3 Scoping Studies**

A number of studies have been completed evaluating the best possible processing route for the Spring Hill mineralisation. Extraction by open cut methods is essential with the option of either heap leach treatment or more conventional carbon-in-pulp (CIP) milling technology. The key elements of metallurgical recovery by each treatment method and the stripping ratios of the ore will determine the most cost effective route. Metallurgical characteristics have now been established and pit optimisation of the three dimensional block model is required prior to a final decision.

### **5.4 Baseline Studies**

#### **5.4.1 Landscape, Flora and Fauna**

An environmental survey of the Spring Hill Project area was conducted by W.A Low Ecological Services in April 1995 in preparation of a Draft Environmental Impact Statement. The survey was commissioned to conduct a general survey of the landscape and biota of the Spring Hill Project area to determine the habit and species present, assess their sensitivity and conservation value and propose development strategies to minimise adverse environmental impact. The recently completed report resulting from the survey forms part of the Spring Hill Project 1995 Annual Report to the NT Department of Mines & Energy.

#### **5.4.2 Archaeology**

An archaeology survey was carried out in May 1995 by Heritage Surveys. The survey was commissioned by Ross Mining to identify possible heritage sites that could be affected by mining operation at Spring Hill involving several open pits, a heap leach pad and infrastructure areas. The resultant report titled "A Survey of Heritage Sites at the Proposed Spring Hill Gold Mine, Northern Territory" is included in the 1995 Annual Report referred to above.

#### **5.4.3 Water Monitoring**

ERA Environmental Services Pty Ltd carried out a background geochemical and water quality survey at Spring Hill over the period March - May 1995.

In March a series of three water surfaces, two of surface water and one of bore water were analysed by ICP-MS semi quantitative scans to provide background information on concentrations of a series of fifty - eight elements.

Water quality was monitored at an initial eight sites and gathered monthly over the March to May period. A report on this survey by ERA Environmental Services is included in the Spring Hill Project 1995 Annual Report to the NT Department of Mines & Energy.

## **6.0 FORWARD PROGRAM**

Further feasibility studies will be essential prior to a decision to mine. The following steps are proposed for implementation during 1996 and 1997.

### **6.1 MINING**

As previously mentioned in Section 5.3 the next requirement will be to undertake a pit optimisation program from the current three dimensional block model. Once a pit design has been accepted, a geotechnical assessment will be required to test pit wall stabilities.

### **6.2 PLANT DESIGN**

Even by assuming at this stage that the less complex heap leach/CIL method will be the chosen processing route, it will still be necessary to select and sterilise by soil or RAB sampling the CIL plant site and associated infrastructure. This will include the leach pads and processing ponds.

### **6.3 WASTE**

The selection of waste dumps will involve a waste management program and site sterilisation and geotechnical assessment. The chemical characteristic of the waste will also need to be evaluated.

### **6.4 WATER BALANCE**

This part of the feasibility study will involve computations on water usage, evaporation and piping.

### **6.5 WATER STORAGE**

A water storage dam site will be selected and a volumetric assessment made. Prior to a final design, a geotechnical assessment involving RC drilling of the dam sites and possibly digging some backhoe pits in the catchment area will be carried out.

### **6.6 ROADS**

An access road route will be selected which will involve geotechnical work such as sediment slump for water run off. A haul road design will involve gradient/distance calculations and digging backhoe pits to determine ease of cutting and stability.

## **6.7 POWER**

Options based on processing plant consumption will be assessed and the preferred option costed out.

## **6.8 GOVERNMENT APPROVALS**

If a decision to proceed to mining is made then we will seek approval for a rationalisation of our tenement holdings. This will involve the resurveying of boundaries to form a single or a small group of larger mining leases appropriate to an operational mine of the size envisaged. All other submissions required by the Department of Mines and Energy such as a plan of operations and an environmental impact statement will be attended to.

## 7.0 REFERENCES

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