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KING ISLAND SCHEELITE LTD.

GEOPEKO LIMITED

**MICROFILMED**

KING ISLAND MAPPING

SURVEY CONTROL REPORT

SEPTEMBER, 1970.

VALLENTINE, LAURIE & DAVIES  
CONSULTING ENGINEERS  
SYDNEY

KING ISLAND SCHEELITE LTD.GEOPEKO LIMITEDKING ISLAND MAPPING  
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KING ISLAND SCHEELITE LTD.KING ISLAND MAPPINGSURVEY CONTROL REPORT1. INTRODUCTION1.1 General

A survey was undertaken during May, 1970, in the vicinity of Grassy, King Island, Tasmania, to establish a Basic Control network for the photogrammetric mapping of the proposed mining development and to assist in the future geological investigation, the engineering design and construction of that development.

1.2 Horizontal Control

The survey was based on the Australian Geodetic Datum. The co-ordinate values are expressed in both the Australian Map Grid and the Integrated Survey Grid to meet the topographic, Real Property and the various civil and mining engineering requirements. The existing local plane rectangular grid which covers the area of the current mining activity is to be replaced by the Integrated Survey Grid.

The relationship between the co-ordinate systems of the existing Mine Grid and the Australian Map Grid and the Integrated Survey Grid is as follows:-

1.3 Comparison of Co-ordinate Systems

| <u>Item</u>            | <u>Mine</u> | <u>A.M.G.</u>                                     | <u>I.S.G.</u> |
|------------------------|-------------|---|---------------|
| Co-ordinate System     | Feet        | Metres  | Metres & Feet |
| Zone Width             | -           | 6°  | 2°            |
| Origin                 | Local       | Intersection of Central Meridian with the Equator |               |
| Central Scale Factor   | 1.000       | 0.9996  | 0.99994       |
| Co-ordinates of Origin |             |   |               |
| East                   | -           | 500,000m  | 300,000m      |
| North                  | -           | 10,000,000m                                       | 5,000,000m    |

The I.S.G. co-ordinates are presented in both metres and feet to allow for the future statutory change in units.

Simple formulae have been developed to convert from the existing Mine Grid to both the A.M.G. and I.S.G. co-ordinate systems.

#### 1.4 The Australian Map Grid

The A.M.G. is defined in paragraph 1.3 of the Technical Manual - "Australian Map Grid" published in 1968 by the National Mapping Council of Australia.

#### "1.3 The Australian Map Grid (A.M.G.)

1.3.1 Co-ordinates on the Australian Map Grid are derived from a Transverse Mercator project of latitudes and longitudes on the Australian Geodetic Datum, 1966 Adjustment. The projection is defined by the formulae for easting, northing, convergence and point scale listed in paragraph 4.3. These formulae were first given by J.C.B. Redfearn in the Empire Survey Review, No.69, 1948. They are correct to less than 1 mm anywhere in a grid zone. For the purposes of this definition, these formulae, and the formula for meridian distance given in paragraph 4.2, are to be regarded as exact, not as the opening terms of infinite series.

1.3.2 The Australian Map Grid corresponds with the Universal Transverse Mercator Grid in all particulars, as follows:

1.3.2.1 Co-ordinates are in metres.

1.3.2.2 Zones are  $6^{\circ}$  wide with  $\frac{1}{2}^{\circ}$  overlaps.

1.3.2.3 A.M.G. Zones are numbered from Zone 47 with central meridian  $99^{\circ}$ E to Zone 58 with central meridian  $165^{\circ}$ E.

1.3.2.4 The origin of each zone is the intersection of the central meridian with the equator.

1.3.2.5 A central Scale Factor,  $k_0$ , of 0.9996 is superimposed on all projected distances.

1.3.2.6 Eastings E are defined by adding 500,000 metres to the value of E given by the formula in paragraph 4.3.2.

1.3.2.7 In the southern hemisphere, Northings N are defined by adding 10,000,000 metres to the negative value of N given by the formula in paragraph 4.3.2.

#### 1.5 The integrated Survey Grid

The I.S.G. is defined in paragraph 2.3 of the Technical Manual - "Integrated Survey Grid" at present being prepared by the Department of Lands, New South Wales.

"2.3 Integrated Survey Grid (I.S.G.)

A traverse Mercator Projection is used for the computation of co-ordinates on the Integrated Survey Grid. Surveys are to be connected to the stations of the State Triangulation and Traverse systems. The Transverse Mercator co-ordinates of these stations have been calculated from latitudes and longitudes on the Australian Geodetic Datum as defined in (2.1).

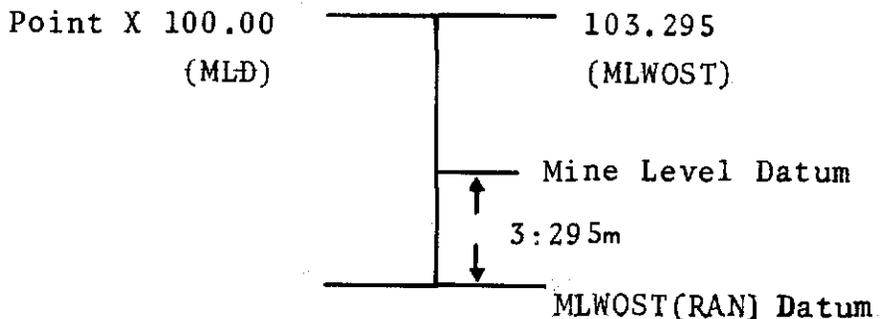
The Integrated Survey Grid is defined as follows:

- 2.3.1 Co-ordinates are in metres for the purpose of definition.
- 2.3.2 Zones are 2° wide with ¼° overlaps.
- 2.3.3 Zones are numbered as follows: Each 6° A.M.G. Zone is subdivided into 3 Integrated Survey Grid Zones. Zone identification numbers consist of 2 parts separated by an oblique. The first part indicates the corresponding A.M.G. zone number, the second part indicates the number of the subdivision from 1 to 3, the numbers increasing eastwards.  
Example: For the eastern part of A.M.G. zone 55 the zone number is 55/3 with the central meridian of 149°.
- 2.3.4 The true origin of each zone is the intersection of the Central Meridian with the Equator.
- 2.3.5 A central scale factor,  $k_0 = 0.99994$  is superimposed on all projected distances.
- 2.3.6 Easting, E, is defined by adding 300,000 metres to the value of y measured from a central meridian.
- 2.3.7 Northing, N, is defined by adding 5,000,000 metres to the value of x measured from the equator. All values of x south of the equator are negative.

1.6 Vertical control

The survey was based on Mean Low Water Ordinary Spring Tide, Grassy Bay as established by the Hydrographic Branch of the Royal Australian Navy.

The existing mine level datum was arbitrary and to convert from levels on this datum to levels on the MLWOST(RAN) datum add 3.295m.



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2. DESCRIPTION OF FIELD SURVEY

- 2.1 A primary network consisting of ten (10) major control points was established utilizing the existing National Mapping Triangulation Stations NM/H/4 Mary Hill and NM/H/6 Tank Hill and all distances were measured using Electronic Distance Measuring Equipment - Tellurometer MR 101 and angles were observed with a "One Second" Theodolite - Wild T2.
- Each line as measured from the control point at either end of that line with each measurement consisting of two coarse readings and ten fine readings. The difference between the two measurements was not greater than 1:200,000. Simultaneous Reciprocal Vertical Angles were also observed at either end. Angular measurements were carried out using the method of "direction" observations with a minimum of six arcs per observation.
- 2.2 Eight (8) Secondary Control Points were also established by "radiations" consisting of angular and distance observations from the major control points.
- 2.3 Eleven (11) additional control points were established by triangulation by King Island Scheelite Ltd. and tied to the primary and secondary networks.
- 2.4 All Control Points were monumented with steel rods in concrete. Their relationship to the topography is shown on the attached map.
- (APPENDIX II)
- 2.5 Photogrammetric Control Points were also established at all control points.
- 2.6 The field survey was undertaken during May, 1970 by Messrs. A. A. Shephard R.S., M.I.S.; D. Schrader of Vallentine, Laurie & Davies with the assistance of Mr. I. Cogle, Mine Surveyor, King Island Scheelite Ltd.

### 3. ADJUSTMENT AND COMPUTATION OF CO-ORDINATES

3.1 The following steps were followed to allow the computation of final co-ordinates:-

- (a) Reduction of the measured distances to Sea Level distances.
- (b) Computation of differences in height between control points.
- (c) Least Squares Adjustment of height differences and calculation of absolute heights (in metres) above Sea Level.
- (d) Calculation of co-ordinates using the method "Least Squares Variation of Co-ordinates on the Spheroid" using the observed angles and mean Sea Level distances. These co-ordinates are expressed in latitudes and longitudes on the Australian Geodetic Datum and in metres on the Australian Map Grid.
- (e) Calculation of co-ordinates expressed in values on the Integrated Survey Grid.

3.2 Extensive use was made of computer programmes in the adjustment and computation of co-ordinates.

3.2.1 The computer programmes held by the Division of National Mapping (Department of National Development) are:

- "TELLYHT" - computes tellurometer distances and trigonometrical heights, or either separately, along a traverse. The computations are designed to be accurate to 1 mm at any distance.
- "VARYCORD" - computes the least squares adjustment of angles, azimuths and distances on the spheroid. The programme is designed to adjust traverses, triangulation, Heran and Aerodist separately or in combination with lines up to 1,000 miles long. Both AGD and AMG co-ordinates can be computed.

3.2.2 The computer programme held by the Lands Department N.S.W. is:

- "LYTCQ2" - computes Integrated Survey Co-ordinates in both metres and feet from geographical co-ordinates (latitudes and longitudes) on the Australian Geodetic Datum.

3.3 A listing of all values in the various systems is attached.

(APPENDIX I)

#### 4. ANALYSIS OF SURVEY

##### 4.1 Horizontal Datum

4.1.1 The horizontal adjustment was made adopting the known values (supplied by the Division of National Mapping) of the two existing trigonometric stations NM/H/4 Mary Hill and NM/H/6 Tank Hill and using forty-three distances and one hundred and fifty-one angles observed.

##### 4.2 Vertical Datum

4.2.1 The vertical adjustment was made adopting the known elevations of Jetty Point, Frog and Bold Head, (supplied by King Island Scheelite Ltd.) and the difference in elevation between the trigonometrical stations at Mary Hill and Tank Hill.

4.2.2 Differences in values given for elevations for Mary Hill and Tank Hill by National Mapping and obtained by this survey are due to the differences in level datum.

##### 4.3 Internal Accuracy

4.3.1 Variation between observed and adjusted measurements:-

| Type of Observation | Variation |         |
|---------------------|-----------|---------|
|                     | Average   | Maximum |
| Angular             | 7.24"     | 58.96"  |
| Linear              | 0.1m      | 1.2m    |

4.3.2 The horizontal accuracy of this survey may be expressed as 1:50,000.

4.3.3 The vertical accuracy may be expressed as  $\pm 0.05 K$  metres (where K is the distance in kilometres between any two stations).  
Elevations are given to the nearest 0.2 metres as they have been obtained by reciprocal vertical angle observations. A higher degree of accuracy can only be obtained by third order levelling techniques.

##### 4.4 Integrated Survey Grid Co-ordinate System

###### 4.4.1 Scale Factor

Grid distances as calculated from the Integrated Survey Grid may be converted to true distances at Sea Level by dividing by 0.99994 i.e.,

Grid Distance  $\div$  0.99994 = True Distance at Sea Level.  
For all but the most precise surveys distances on the Integrated Survey Grid can be accepted as field distances.

#### 4.4.2 Grid Convergence

Grid convergence is the angular quantity to be added algebraically to a True Azimuth (or Geodetic Azimuth) to obtain a Grid Bearing, i.e.  $\text{Grid Bearing} = \text{True Azimuth} + \text{Grid Convergence}$ .

In the southern hemisphere, grid convergence is positive east of the central meridian, and negative west, e.g.

|  |                          |        |
|--|--------------------------|--------|
| True Azimuth from Tank Hill to Mary Hill | = $311^{\circ}49'29.5''$ | } Zone |
| Grid Convergence at Tank Hill            | = $1^{\circ}56'25.7''$   | } 54   |

|   |                          |  |
|---|--------------------------|--|
| ∴ Grid Bearing (Tank Hill to Mary Hill) | = $311^{\circ}49'29.5''$ |  |
|   | + $1^{\circ}56'25.7''$   |  |
|   | = $313^{\circ}45'55.2''$ |  |

|                              |                          |  |
|------------------------------|--------------------------|--|
| Grid Bearing = Plane Bearing | = $313^{\circ}45'55.2''$ |  |
|------------------------------|--------------------------|--|

#### 4.5 Feet Conversion Factor

Although co-ordinates on the Australian Map Grid and Integrated Survey Grid are expressed in metres, some measurements in feet are required for this survey. The conversion ratios laid down in the Weights and Measures (National Standards) Regulations for use in Australia are:-

1 yard = 0.9144 metres exactly

1 foot = 1/3 yard

whence 1 foot = 0.3048 metres exactly (reference A.M.G. Technical Manual paragraph 1.5).

5. CONVERSION FORMULAE BETWEEN CO-ORDINATE SYSTEMS

5.1 Type of Equation

Equations of the type

$$\bar{E} = AE + BN + CE$$

$$\bar{N} = -BE + AN + CY$$

have been derived where

E, N are co-ordinates in the existing system

$\bar{E}, \bar{N}$  are co-ordinates in the new system

CE, CN are the difference or shift in the origin of co-ordinates of the two (2) systems.

and A, B, are factors derived from the scale and azimuth differences between the two system.

i.e. (scale factor) =  $\tan^{-1} \frac{B}{A}$

5.2 Mine Grid (feet) to Integrated Survey Grid (feet)

$$A = 0.9894370$$

$$B = 0.1449294$$

$$\lambda = 0.9999950$$

$$\epsilon = 8^{\circ}20'00$$

$$CE = +607,196.48 \text{ feet}$$

$$CN = +1,766,631.35 \text{ feet}$$

5.3 Mine Grid (feet) to Australian Map Grid (metres).

$$A = 0.2994175$$

$$B = 0.0577032$$

$$\lambda = 0.3049270$$

$$\epsilon = 10^{\circ}54'30''$$

$$CE = +725,153.21 \text{ metres}$$

$$CN = +5,537,488.93 \text{ metres}$$

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6. SHEET LAYOUT

The basic sheets have been prepared on the Integrated Survey Grid Co-ordinate System and are numbered by subtracting 500,000 metres North and 200,000 metres East from the Integrated Survey Grid co-ordinates of the southwest corner of each sheet, and then using the first two (or three) digits of the remaining number, (i.e. the thousands)

e.g. Sheet 6516 has co-ordinates

5(65),000 Metres North

2(16),000 Metres East

7. CERTIFICATION OF SURVEY

The field reconnaissance and observations, and office reductions, calculations and preparation of relevant data was undertaken to generally accepted standards of accuracy and was under the supervision of Mr. A. A. Shephard R.S., M.I.S.

8. ACKNOWLEDGMENTS

The assistance of the staff of King Island Scheelite Ltd. and Geopeko Limited during the field survey, and the Directorate of Military Survey, Royal Australian Army, and Department of Lands, New South Wales in the calculations of co-ordinate values is gratefully acknowledged.

The staff of Peko-Wallsend Ltd. aided materially in the initial planning and in the continued liaison on the project and also in the preparation of this report.

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| STATION        |        |       | GEOGRAPHIC CO-ORDINATES |    |       |                 |    |       |      | AUSTRALIAN MAP |             |
|----------------|--------|-------|-------------------------|----|-------|-----------------|----|-------|------|----------------|-------------|
| Name           | Serial | KIS   | Latitude (South)        |    |       | Longitude(East) |    |       | Zone | Eastings       | Northings   |
|                | No.    | No.   | o                       | '  | "     | o               | '  | "     |      | Ms             | Ms          |
| Mary Hill      | 4      | 1     | 39                      | 58 | 30.06 | 143             | 55 | 24.48 | 54   | 749 657.20     | 5570 906.29 |
| Tank Hill      | 6      | 3     | 40                      | 02 | 16.56 | 144             | 00 | 53.27 | 54   | 757 221.35     | 5563 661.65 |
| Mary Hill Ecce | 2      |       | 39                      | 58 | 30.10 | 143             | 55 | 24.53 | 54   | 749 658.46     | 5570 905.09 |
| Wiggins        | 4      |       | 39                      | 59 | 18.88 | 144             | 00 | 54.25 | 54   | 757 430.22     | 5569 140.13 |
| Ferguson       | 5      |       | 39                      | 59 | 0.10  | 144             | 00 | 0.85  | 54   | 756 183.11     | 5569 762.09 |
| Gravel Pit     | 6      |       | 40                      | 00 | 28.49 | 144             | 00 | 24.26 | 54   | 756 646.34     | 5567 017.36 |
|                | 10     | 34/18 | 40                      | 01 | 54.51 | 144             | 03 | 56.92 | 54   | 761 598.10     | 5564 192.96 |
| Russell        | 12     |       | 40                      | 05 | 22.95 | 144             | 00 | 40.46 | 54   | 756 723.03     | 5557 923.66 |
| Rox            | 14     |       | 40                      | 02 | 50.50 | 144             | 01 | 15.65 | 54   | 757 716.49     | 5562 596.94 |
| Bend           | 15     |       | 40                      | 02 | 59.16 | 144             | 02 | 54.21 | 54   | 760 043.13     | 5562 250.14 |
| Bend Ecce      | 16     |       | 40                      | 02 | 59.29 | 144             | 02 | 55.69 | 54   | 760 077.96     | 5562 244.94 |
| Philby         | 18     |       | 39                      | 59 | 03.27 | 144             | 02 | 52.44 | 54   | 760 250.20     | 5569 526.07 |
| Dam            | 20     |       | 40                      | 02 | 17.83 | 144             | 03 | 33.56 | 54   | 761 019.55     | 5563 492.74 |
| Tennant        | 21     |       | 39                      | 58 | 59.77 | 144             | 04 | 43.51 | 54   | 762 888.76     | 556 543.33  |
| Doddle         |        |       |                         |    |       |                 |    |       |      | 760 811.64     | 5561 956.43 |
| Bold Head      | 23     | 34/7  | 40                      | 01 | 40.67 | 144             | 03 | 59.69 | 54   | 761 678.39     | 5564 617.28 |
| Sleath         | 24     |       | 40                      | 01 | 34.50 | 144             | 02 | 55.87 | 54   | 760 171.91     | 5564 859.57 |
| Bold Head Ecce | 26     |       | 40                      | 01 | 40.36 | 144             | 04 | 1.30  | 54   | 761 716.84     | 5564 625.53 |
| Denison        | 28     |       | 40                      | 00 | 34.05 | 144             | 03 | 48.97 | 54   | 761 495.05     | 5566 680.40 |
| Pat            | 30     |       | 40                      | 02 | 17.65 | 144             | 04 | 5.01  | 54   | 761 765.14     | 5563 472.49 |
| Moore          | 31     |       | 40                      | 00 | 30.78 | 144             | 02 | 44.98 | 54   | 759 980.98     | 5566 833.42 |
| Skipworth      |        |       |                         |    |       |                 |    |       |      |                |             |
| Mark           | 36     |       | 40                      | 02 | 40.99 | 144             | 04 | 6.13  | 54   | 761 766.91     | 5562 752.02 |
| Myrtle         | 37     |       | 40                      | 03 | 0.54  | 144             | 03 | 41.27 | 54   | 761 156.95     | 5562 169.26 |
| Mike           | 38     |       | 40                      | 03 | 6.58  | 144             | 04 | 3.82  | 54   | 761 684.83     | 5561 964.42 |
| Tip            | 39     |       | 40                      | 03 | 26.65 | 144             | 03 | 57.03 | 54   | 761 502.65     | 5561 351.26 |
| Duncan         | 40     |       | 40                      | 02 | 31.91 | 144             | 03 | 49.62 | 54   | 761 385.40     | 5563 045.14 |
| Golf           | 41     |       | 40                      | 03 | 51.20 | 144             | 03 | 32.01 | 54   | 760 883.83     | 5560 614.49 |
| Jetty Point    | 43     |       | 40                      | 03 | 59.15 | 144             | 03 | 51.13 | 54   | 761 328.34     | 5560 353.80 |
| Frog           | 44     |       | 40                      | 04 | 7.79  | 144             | 02 | 51.53 | 54   | 759 907.22     | 5560 135.89 |
| Tosh           | 45     |       | 40                      | 02 | 36.91 | 144             | 05 | 40.06 | 54   | 763 997.73     | 5562 800.76 |
| Church         | 47     |       | 40                      | 03 | 5.28  | 144             | 03 | 4.57  | 54   | 760 282.18     | 5562 052.88 |
| Dump           | 48     |       | 40                      | 03 | 25.64 | 144             | 03 | 28.13 | 54   | 760 818.97     | 5561 405.88 |
| Ramp           | 49     |       | 40                      | 03 | 18.71 | 144             | 03 | 45.63 | 54   | 761 240.92     | 5561 605.45 |
|                |        | B19   |                         |    |       |                 |    |       |      | 760 524.99     | 5561 623.29 |
| Hall           |        |       |                         |    |       |                 |    |       |      | 760 562.73     | 5562 216.03 |
| .School        |        |       |                         |    |       |                 |    |       |      | 760 852.87     | 5562 172.41 |

TABULATION OF CO-ORDINATES.

| GRID CO-ORDINATES |             |    |       | INTEGRATED SURVEY GRID CO-ORDINATES |                |                 |              |                |                 |              | MINE GRID CO-ORDINATES |    |           |                | STATION         |              |                |               |            |      |
|-------------------|-------------|----|-------|-------------------------------------|----------------|-----------------|--------------|----------------|-----------------|--------------|------------------------|----|-----------|----------------|-----------------|--------------|----------------|---------------|------------|------|
| Height<br>Ms      | Convergence |    |       | Zone                                | Eastings<br>Ms | Northings<br>Ms | Height<br>Ms | Eastings<br>Ft | Northings<br>Ft | Height<br>Ft | Convergence            |    |           | Eastings<br>Ft | Northings<br>Ft | Height<br>Ft | Name           | Serial<br>No. | KIS<br>No. |      |
|                   | o           | '  | "     |                                     |                |                 |              |                |                 |              | o                      | '  | "         |                |                 |              |                |               |            |      |
| 132.6             | +1          | 52 | 44.98 | 54/3                                | 208 041.42     | 572 940.04      | 132.6        | 682 550.60     | 1879 724.55     | 434.7        | -0                     | 41 | 30.02     |                |                 |              | Mary Hill      | 4             | 1          |      |
| 159.6             | +1          | 56 | 25.67 | 54/3                                | 215 920.31     | 566 044.66      | 159.6        | 708 399.98     | 1857 101.91     | 523.6        | -0                     | 38 | 01.73     |                |                 |              | Tank Hill      | 6             | 3          |      |
| 132.4             | +1          | 52 | 45.01 | 54/3                                | 208 042.73     | 572 938.89      | 132.4        | 682 554.89     | 1879 720.78     | 434.4        | -0                     | 41 | 29.98     |                |                 |              | Mary Hill Ecce |               | 2          |      |
| 138.8             | +1          | 56 | 19.15 | 54/3                                | 215 883.06     | 571 524.87      | 138.8        | 708 277.75     | 1875 081.60     | 455.0        | -0                     | 37 | 58.75     |                |                 |              | Wiggins        |               | 4          |      |
| 117.7             | +1          | 55 | 44.02 | 54/3                                | 214 609.78     | 572 090.04      | 117.7        | 704 100.34     | 1876 935.82     | 386.2        | -0                     | 38 | 32.82     |                |                 |              | Ferguson       |               | 5          |      |
| 137.8             | +1          | 56 | 2.64  | 54/3                                | 215 195.49     | 569 369.89      | 137.8        | 706 021.95     | 1868 011.45     | 452.1        | -0                     | 38 | 18.95     |                |                 |              | Gravel Pit     |               | 6          |      |
|                   | +1          | 58 | 23.11 | 54/3                                | 220 267.02     | 566 771.72      |              | 722 660.84     | 1859 487.26     |              | -0                     | 36 | 03.29     | 100 787.84     | 108 610.71      |              |                |               |            |      |
| 95.0              | +1          | 56 | 24.91 | 54/3                                | 215 680.45     | 560 292.30      | 95.0         | 707 613.02     | 1838 229.32     | 311.4        | -0                     | 38 | 12.43     |                |                 |              | Russell        |               | 12         |      |
|                   | +1          | 56 | 41.47 | 54/3                                | 216 462.57     | 565 003.67      |              | 710 179.04     | 1853 686.59     |              | -0                     | 37 | 47.77     |                |                 |              |                | Rox           |            | 14   |
|                   | +1          | 57 | 45.34 | 54/3                                | 218 801.50     | 564 761.84      |              | 718 852.69     | 1852 893.19     |              | -0                     | 36 | 44.45     |                |                 |              |                | Bend          |            | 15   |
| 125.7             | +1          | 57 | 46.30 | 54/3                                | 218 836.51     | 564 758.22      | 125.7        | 717 967.56     | 1852 881.31     | 412.4        | -0                     | 36 | 43.50     |                |                 |              | Bend Ecce      |               | 16         |      |
| 104.0             | +1          | 57 | 34.59 | 54/3                                | 218 681.76     | 572 036.74      | 104.0        | 717 459.84     | 1876 760.95     | 341.2        | -0                     | 36 | 42.59     |                |                 |              | Philby         |               | 18         |      |
|                   | +1          | 58 | 9.01  | 54/3                                | 219 720.74     | 566 046.52      |              | 720 868.56     | 1857 108.02     |              | -0                     | 36 | 18.61     | 99 358.92      | 105 996.28      |              |                | Dam           |            | 20   |
| 111.6             | +1          | 58 | 45.94 | 54/3                                | 221 315.77     | 572 172.30      | 111.6        | 726 101.62     | 1877 205.71     | 365.8        | -0                     | 35 | 31.17     |                |                 |              | Tennant        |               | 21         |      |
|                   |             |    |       |                                     | 219 582.11     | 564 503.07      |              | 720 413.76     | 1852 044.17     |              |                        |    |           | 99 643.52      | 100 920.11      |              |                | Doddle        |            |      |
| 129.2             | +1          | 58 | 24.33 | 54/3                                | 220 328.15     | 567 199.03      | 129.2        | 722 861.38     | 1860 889.21     | 424.0        | -0                     | 36 | 01.33     | 100 783.12     | 110 027.21      |              | Bold Head      |               | 23         | 34/7 |
| 110.0             | +1          | 57 | 42.96 | 54/3                                | 218 812.95     | 567 373.35      | 110.0        | 717 890.24     | 1861 461.14     | 360.9        | -0                     | 36 | 42.31     |                |                 |              | Sleath         |               | 24         |      |
| 128.8             | +1          | 58 | 25.35 | 54/3                                | 220 366.17     | 567 208.99      | 128.8        | 722 986.13     | 1860 921.88     | 422.5        | -0                     | 36 | 00.30     |                |                 |              | Bold Head Ecce |               | 26         |      |
| 115.2             | +1          | 58 | 14.70 | 54/3                                | 220 052.48     | 569 250.96      | 115.2        | 721 956.97     | 1867 621.27     | 378.0        | -0                     | 36 | 07.39     |                |                 |              | Denison        |               | 28         |      |
|                   | +1          | 58 | 29.27 | 54/3                                | 220 466.17     | 566 059.78      |              | 723 314.20     | 1857 151.51     |              | -0                     | 35 | 58.37     | 101 773.03     | 106 393.93      |              |                | Pat           |            | 30   |
| 105.2             | +1          | 57 | 33.35 | 54/3                                | 218 533.71     | 569 335.83      | 105.2        | 716 974.10     | 1867 899.71     | 345.1        | -0                     | 36 | 48.50     |                |                 |              | Moore          |               | 31         |      |
|                   |             |    |       |                                     |                |                 |              |                |                 |              |                        |    |           |                |                 |              |                |               | Skipworth  |      |
| 88.8              | +1          | 58 | 30.95 | 54/3                                | 220 500.29     | 565 340.41      | 88.8         | 723 426.15     | 1854 791.38     | 291.3        | -0                     | 35 | 57.94     | 102 226.07     | 104 074.02      |              | Mark           |               | 36         |      |
| 111.3             | +1          | 58 | 15.73 | 54/3                                | 219 917.37     | 564 731.11      | 111.3        | 721 513.68     | 1852 792.35     | 365.2        | -0                     | 36 | 14.18     |                |                 |              | Myrtle         |               | 37         |      |
|                   | +1          | 58 | 30.51 | 54/3                                | 220 453.69     | 564 550.26      |              | 723 273.25     | 1852 199.01     |              | -0                     | 35 | 59.75     | 102 450.65     | 101 487.37      |              |                | Mike          |            | 38   |
|                   | +1          | 58 | 26.95 | 54/3                                | 220 299.31     | 563 929.81      |              | 722 766.78     | 1850 163.40     |              | -0                     | 36 | 04.37     | 102 243.99     | 99 400.28       |              |                | Tip           |            | 39   |
|                   | +1          | 58 | 19.94 | 54/3                                | 220 106.16     | 565 615.98      |              | 722 113.07     | 1855 695.49     |              | -0                     | 36 | 08.45     | 100 815.24     | 104 781.66      |              |                | Duncan        |            | 40   |
| 28.4              | +1          | 58 | 11.83 | 54/3                                | 219 714.47     | 563 166.29      | 28.4         | 720 848.01     | 1847 658.43     | 93.5         | -0                     | 36 | 20.78     | 100 708.96     | 96 643.68       |              | Golf           |               | 41         |      |
| 6.6               | +1          | 58 | 24.48 | 54/3                                | 220 170.06     | 562 925.94      | 6.6          | 722 342.70     | 1846 869.89     | 21.5         | -0                     | 36 | 08.57     |                |                 |              | Jetty Point    |               | 43         |      |
| 20.6              | +1          | 57 | 46.41 | 54/3                                | 218 760.76     | 562 644.50      | 20.6         | 717 719.02     | 1845 946.53     | 67.9         | -0                     | 36 | 47.05     | 97 861.06      | 94 496.64       |              | Frog           |               | 44         |      |
|                   | +1          | 59 | 31.32 | 54/3                                | 222 725.69     | 565 489.25      |              | 730 727.34     | 1855 279.70     |              | 307.4                  | -0 | 34        | 57.45          |                 |              |                | Tosh          |            | 45   |
| 93.6              | +1          | 57 | 52.27 | 54/3                                | 219 049.07     | 564 575.61      |              | 718 664.94     | 1852 282.17     |              | -0                     | 36 | 37.86     | 97 879.26      | 100 902.03      |              | Church         |               | 47         |      |
|                   | +1          | 58 | 8.28  | 54/3                                | 219 614.15     | 563 953.64      |              | 720 518.88     | 1850 241.59     |              | -0                     | 36 | 22.96     | 100 008.93     | 99 151.94       |              | Dump           |               | 48         |      |
|                   | +1          | 58 | 19.28 | 54/3                                | 220 026.53     | 564 171.87      |              | 721 871.83     | 1850 957.59     |              | -0                     | 36 | 11.61     | 101 243.61     | 100 056.32      |              | Ramp           |               | 49         |      |
|                   |             |    |       |                                     | 219 310.83     | 564 157.52      |              | 719 523.73     | 1850 910.53     |              |                        |    |           | 98 927.18      | 99 669.45       |              |                |               |            | B19  |
|                   |             |    |       |                                     | 219 321.91     | 564 751.12      |              | 719 560.07     | 1852 858.00     |              |                        |    |           | 98 680.89      | 101 601.63      |              | Hall           |               |            |      |
|                   |             |    |       | 219 613.58                          | 564 720.58     |                 | 720 517.01   | 1852 757.84    |                 |              |                        |    | 99 642.25 | 101 641.22     |                 | School       |                |               |            |      |

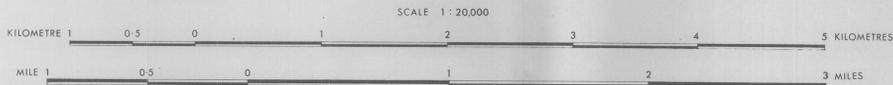


TABULATION OF CO-ORDINATES.

| STATION        |            |         | GEOGRAPHIC CO-ORDINATES |                  |      | AUSTRALIAN MAP |              |           | GRID CO-ORDINATES |      |             | INTEGRATED SURVEY GRID CO-ORDINATES |           |             |              |           |             | MINE GRID CO-ORDINATES |              |           | STATION        |            |         |   |
|----------------|------------|---------|-------------------------|------------------|------|----------------|--------------|-----------|-------------------|------|-------------|-------------------------------------|-----------|-------------|--------------|-----------|-------------|------------------------|--------------|-----------|----------------|------------|---------|---|
| Name           | Serial No. | KIS No. | Latitude (South)        | Longitude (East) | Zone | Eastings Ms    | Northings Ms | Height Ms | Convergence       | Zone | Eastings Ms | Northings Ms                        | Height Ms | Eastings Ft | Northings Ft | Height Ft | Convergence | Eastings Ft            | Northings Ft | Height Ft | Name           | Serial No. | KIS No. |   |
| Mary Hill      | 4          | 1       | 39 58 30.06             | 143 55 24.48     | 54   | 749 657.20     | 5570 906.29  | 132.6     | +1 52 44.98       | 54/3 | 208 041.42  | 572 940.04                          | 132.6     | 682 550.60  | 1879 724.55  | 434.7     | -0 41 30.02 |                        |              |           |                | Mary Hill  | 4       | 1 |
| Tank Hill      | 6          | 3       | 40 02 16.56             | 144 00 53.27     | 54   | 757 221.35     | 5563 661.65  | 159.6     | +1 56 25.67       | 54/3 | 215 920.31  | 566 044.66                          | 159.6     | 708 399.98  | 1857 101.91  | 523.6     | -0 38 01.73 |                        |              |           |                | Tank Hill  | 6       | 3 |
| Mary Hill Ecce | 2          |         | 39 58 30.10             | 143 55 24.53     | 54   | 749 658.46     | 5570 905.09  | 132.4     | +1 52 45.01       | 54/3 | 208 042.73  | 572 938.89                          | 132.4     | 682 554.89  | 1879 720.78  | 434.4     | -0 41 29.98 |                        |              |           | Mary Hill Ecce | 2          |         |   |
| Wiggins        | 4          |         | 39 59 18.88             | 144 00 54.25     | 54   | 757 430.22     | 5569 140.13  | 138.8     | +1 56 19.15       | 54/3 | 215 883.06  | 571 524.87                          | 138.8     | 708 277.75  | 1875 081.60  | 455.0     | -0 37 58.75 |                        |              |           | Wiggins        | 4          |         |   |
| Ferguson       | 5          |         | 39 59 0.10              | 144 00 0.85      | 54   | 756 183.11     | 5569 762.09  | 117.7     | +1 55 44.02       | 54/3 | 214 609.78  | 572 090.04                          | 117.7     | 704 100.34  | 1876 935.82  | 386.2     | -0 38 32.82 |                        |              |           | Ferguson       | 5          |         |   |
| Gravel Pit     | 6          |         | 40 00 28.49             | 144 00 24.26     | 54   | 756 646.34     | 5567 017.36  | 137.8     | +1 56 2.64        | 54/3 | 215 195.49  | 569 369.89                          | 137.8     | 706 021.95  | 1868 011.45  | 452.1     | -0 38 18.95 |                        |              |           | Gravel Pit     | 6          |         |   |
|                | 10         | 34/18   | 40 01 54.51             | 144 03 56.92     | 54   | 761 598.10     | 5564 192.96  |           | +1 58 23.11       | 54/3 | 220 267.02  | 566 771.72                          |           | 722 660.84  | 1859 487.26  |           | -0 36 03.29 | 100 787.84             | 108 610.71   |           |                | 10         | 34/18   |   |
| Russell        | 12         |         | 40 05 22.95             | 144 00 40.46     | 54   | 756 723.03     | 5557 923.66  | 95.0      | +1 56 24.91       | 54/3 | 215 680.45  | 560 292.30                          | 95.0      | 707 613.02  | 1838 229.32  | 311.4     | -0 38 12.43 |                        |              |           | Russell        | 12         |         |   |
| Rox            | 14         |         | 40 02 50.50             | 144 01 15.65     | 54   | 757 716.49     | 5562 596.94  |           | +1 56 41.47       | 54/3 | 216 462.57  | 565 003.67                          |           | 710 179.04  | 1853 686.59  |           | -0 37 47.77 |                        |              |           | Rox            | 14         |         |   |
| Bend           | 15         |         | 40 02 59.16             | 144 02 54.21     | 54   | 760 043.13     | 5562 250.14  |           | +1 57 45.34       | 54/3 | 218 801.50  | 564 761.84                          |           | 718 852.69  | 1852 893.19  |           | -0 36 44.45 |                        |              |           | Bend           | 15         |         |   |
| Bend Ecce      | 16         |         | 40 02 59.29             | 144 02 55.69     | 54   | 760 077.96     | 5562 244.94  | 125.7     | +1 57 46.30       | 54/3 | 218 836.51  | 564 758.22                          | 125.7     | 717 967.56  | 1852 881.31  | 412.4     | -0 36 43.50 |                        |              |           | Bend Ecce      | 16         |         |   |
| Philby         | 18         |         | 39 59 03.27             | 144 02 52.44     | 54   | 760 250.20     | 5569 526.07  | 104.0     | +1 57 34.59       | 54/3 | 218 681.76  | 572 038.74                          | 104.0     | 717 459.84  | 1876 760.95  | 341.2     | -0 36 42.59 |                        |              |           | Philby         | 18         |         |   |
| Dam            | 20         |         | 40 02 17.83             | 144 03 33.56     | 54   | 761 019.55     | 5563 492.74  |           | +1 58 9.01        | 54/3 | 219 720.74  | 566 046.52                          |           | 720 868.56  | 1857 108.02  |           | -0 36 18.61 | 99 358.92              | 105 996.28   |           | Dam            | 20         |         |   |
| Tennant        | 21         |         | 39 58 59.77             | 144 04 43.51     | 54   | 762 888.76     | 556 543.33   | 111.6     | +1 58 45.94       | 54/3 | 221 315.77  | 572 172.30                          | 111.6     | 726 101.62  | 1877 205.71  | 365.8     | -0 35 31.17 |                        |              |           | Tennant        | 21         |         |   |
| Doddle         |            |         |                         |                  |      | 760 811.64     | 5561 956.43  |           |                   |      | 219 582.11  | 564 503.07                          |           | 720 413.76  | 1852 044.17  |           |             | 99 643.52              | 100 920.11   |           | Doddle         |            |         |   |
| Bold Head      | 23         | 34/7    | 40 01 40.67             | 144 03 59.69     | 54   | 761 678.39     | 5564 617.28  | 129.2     | +1 58 24.33       | 54/3 | 220 328.15  | 567 199.03                          | 129.2     | 722 861.38  | 1860 889.21  | 424.0     | -0 36 01.33 | 100 783.12             | 110 027.21   |           | Bold Head      | 23         | 34/7    |   |
| Sleath         | 24         |         | 40 01 34.50             | 144 02 55.87     | 54   | 760 171.91     | 5564 859.57  | 110.0     | +1 57 42.96       | 54/3 | 218 812.95  | 567 373.35                          | 110.0     | 717 890.24  | 1861 461.14  | 360.9     | -0 36 42.31 |                        |              |           | Sleath         | 24         |         |   |
| Bold Head Ecce | 26         |         | 40 01 40.36             | 144 04 1.30      | 54   | 761 716.84     | 5564 625.53  | 128.8     | +1 58 25.35       | 54/3 | 220 366.17  | 567 208.99                          | 128.8     | 722 986.13  | 1860 921.88  | 422.5     | -0 36 00.30 |                        |              |           | Bold Head Ecce | 26         |         |   |
| Denison        | 28         |         | 40 00 34.05             | 144 03 48.97     | 54   | 761 495.05     | 5566 680.40  | 115.2     | +1 58 14.70       | 54/3 | 220 052.48  | 569 250.96                          | 115.2     | 721 956.97  | 1867 621.27  | 378.0     | -0 36 07.39 |                        |              |           | Denison        | 28         |         |   |
| Par            | 30         |         | 40 02 17.65             | 144 04 5.01      | 54   | 761 765.14     | 5563 472.49  |           | +1 58 29.27       | 54/3 | 220 466.17  | 566 059.78                          |           | 723 314.20  | 1857 151.51  |           | -0 35 58.37 | 101 773.03             | 106 393.93   |           | Par            | 30         |         |   |
| Moore          | 31         |         | 40 00 30.78             | 144 02 44.98     | 54   | 759 980.98     | 5566 833.42  | 105.2     | +1 57 33.35       | 54/3 | 218 533.71  | 569 335.83                          | 105.2     | 716 974.10  | 1867 899.71  | 345.1     | -0 36 48.50 |                        |              |           | Moore          | 31         |         |   |
| Skipworth      |            |         |                         |                  |      |                |              |           |                   |      |             |                                     |           |             |              |           |             |                        |              |           | Skipworth      |            |         |   |
| Mark           | 36         |         | 40 02 40.99             | 144 04 6.13      | 54   | 761 766.91     | 5562 752.02  | 88.8      | +1 58 30.95       | 54/3 | 220 500.29  | 565 340.41                          | 88.8      | 723 426.15  | 1854 791.38  | 291.3     | -0 35 57.94 | 102 226.07             | 104 074.02   |           | Mark           | 36         |         |   |
| Myrtle         | 37         |         | 40 03 0.54              | 144 03 41.27     | 54   | 761 156.95     | 5562 169.26  | 111.3     | +1 58 15.73       | 54/3 | 219 917.37  | 564 731.11                          | 111.3     | 721 513.68  | 1852 792.35  | 365.2     | -0 36 14.18 |                        |              |           | Myrtle         | 37         |         |   |
| Mike           | 38         |         | 40 03 6.58              | 144 04 3.82      | 54   | 761 684.83     | 5561 964.42  |           | +1 58 30.51       | 54/3 | 220 453.69  | 564 550.26                          |           | 723 273.25  | 1852 199.01  |           | -0 35 59.75 | 102 450.65             | 101 487.37   |           | Mike           | 38         |         |   |
| Tip            | 39         |         | 40 03 26.65             | 144 03 57.03     | 54   | 761 502.65     | 5561 351.26  |           | +1 58 26.95       | 54/3 | 220 299.31  | 563 929.81                          |           | 722 766.78  | 1850 163.40  |           | -0 36 04.37 | 102 243.99             | 99 400.28    |           | Tip            | 39         |         |   |
| Duncan         | 40         |         | 40 02 31.91             | 144 03 49.62     | 54   | 761 385.40     | 5563 045.14  |           | +1 58 19.94       | 54/3 | 220 106.16  | 565 615.98                          |           | 722 113.07  | 1855 695.49  |           | -0 36 08.45 | 100 815.24             | 104 781.66   |           | Duncan         | 40         |         |   |
| Golf           | 41         |         | 40 03 51.20             | 144 03 32.01     | 54   | 760 883.83     | 5560 614.49  | 28.4      | +1 58 11.83       | 54/3 | 219 714.47  | 563 166.29                          | 28.4      | 720 848.01  | 1847 658.43  | 93.5      | -0 36 20.78 | 100 708.96             | 96 643.68    |           | Golf           | 41         |         |   |
| Jetty Point    | 43         |         | 40 03 59.15             | 144 03 51.13     | 54   | 761 328.34     | 5560 333.80  | 6.6       | +1 58 24.48       | 54/3 | 220 170.06  | 562 925.94                          | 6.6       | 722 342.70  | 1846 869.89  | 21.5      | -0 36 08.57 |                        |              |           | Jetty Point    | 43         |         |   |
| Frog           | 44         |         | 40 04 7.79              | 144 02 51.53     | 54   | 759 907.22     | 5560 135.89  | 20.6      | +1 57 46.41       | 54/3 | 218 760.76  | 562 644.50                          | 20.6      | 717 719.02  | 1845 946.53  | 67.9      | -0 36 47.05 | 97 861.06              | 94 496.64    |           | Frog           | 44         |         |   |
| Tosh           | 45         |         | 40 02 36.91             | 144 05 40.06     | 54   | 763 997.73     | 5562 800.76  | 93.6      | +1 59 31.32       | 54/3 | 222 725.69  | 565 489.25                          | 93.6      | 730 727.34  | 1855 279.70  | 307.4     | -0 34 57.45 |                        |              |           | Tosh           | 45         |         |   |
| Church         | 47         |         | 40 03 5.28              | 144 03 4.57      | 54   | 760 282.18     | 5562 052.88  |           | +1 57 52.27       | 54/3 | 219 049.07  | 564 575.61                          |           | 718 664.94  | 1852 282.17  |           | -0 36 37.86 | 97 879.26              | 100 902.03   |           | Church         | 47         |         |   |
| Dump           | 48         |         | 40 03 25.64             | 144 03 28.13     | 54   | 760 818.97     | 5561 405.88  |           | +1 58 8.28        | 54/3 | 219 614.15  | 563 953.64                          |           | 720 518.88  | 1850 241.59  |           | -0 36 22.96 | 100 008.93             | 99 151.94    |           | Dump           | 48         |         |   |
| Ramp           | 49         |         | 40 03 18.71             | 144 03 45.63     | 54   | 761 240.92     | 5561 605.45  |           | +1 58 19.28       | 54/3 | 220 026.53  | 564 171.87                          |           | 721 871.83  | 1850 957.59  |           | -0 36 11.61 | 101 243.61             | 100 056.32   |           | Ramp           | 49         |         |   |
| Hall           |            | 819     |                         |                  |      | 760 524.99     | 5561 623.29  |           |                   |      | 219 310.83  | 564 157.52                          |           | 719 523.73  | 1850 910.53  |           |             | 98 927.18              | 99 669.45    |           | Hall           |            | 819     |   |
| School         |            |         |                         |                  |      | 760 562.73     | 5562 216.03  |           |                   |      | 219 321.91  | 564 751.12                          |           | 719 560.07  | 1852 858.00  |           |             | 98 680.89              | 101 601.63   |           | School         |            |         |   |
|                |            |         |                         |                  |      | 760 852.87     | 5562 172.41  |           |                   |      | 219 613.58  | 564 720.58                          |           | 720 517.01  | 1852 757.84  |           |             | 99 642.25              | 101 641.22   |           |                |            |         |   |

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FLOWN IN 1967. SCALE OF 1 : 32,500



JUNE 1970

CONTROL DIAGRAM

----- HORIZONTAL ANGLES  
----- TELLUROMETER DISTANCES

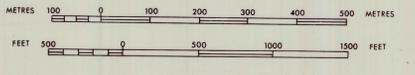




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JUNE 1970

SHEET INDEX

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| 7012 | 7016 | 7020 |
| 6512 | 6516 | 6520 |
| 6012 | 6016 | 6020 |

CO-ORDINATE SYSTEM IS THE INTEGRATED CO-ORDINATE SYSTEM BASED ON AUSTRALIAN GEODETIC DATUM.

LEVEL DATUM IS MEAN LOW WATER ORDINARY SPRING (RL) AS ESTABLISHED BY H.M.A.S. "TALLAROOK" 1949.

COMPILED BY  
VALLENTINE, LAURIE & DAVIES FROM AERIAL  
PHOTOGRAPHY (TASMANIAN LANDS DEPT.)  
FLOWN IN 1967. SCALE OF 1:32,500



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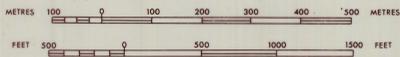


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574000 N  
573000 N  
572000 N  
571000 N  
570000 N

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JUNE 1970

SHEET INDEX

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| 6512 | 6516 | 6520 |
| 6012 | 6016 | 6020 |

CO-ORDINATE SYSTEM IS THE INTEGRATED CO-ORDINATE SYSTEM BASED ON AUSTRALIAN GEODETIC DATUM.

LEVEL DATUM IS MEAN LOW WATER ORDINARY SPRING (IRANI) AS ESTABLISHED BY H.M.A.S. "TALLAROOK" 1949.



COMPILED BY VALLENTINE, LAURIE & DAVIES FROM AERIAL PHOTOGRAPHY (TASMANIAN LANDS DEPT.) FLOWN IN 1967. SCALE OF 1:32,500

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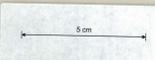
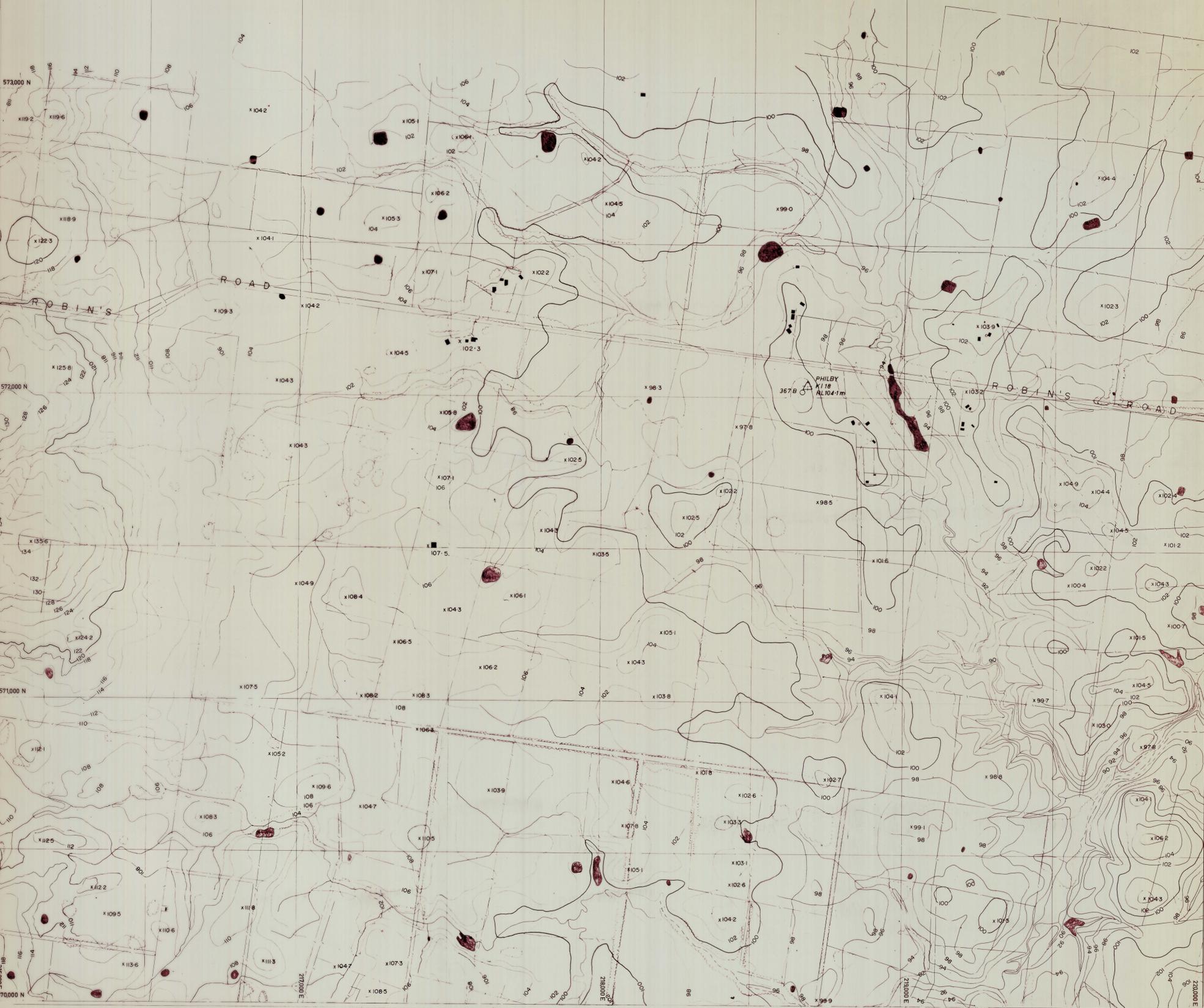
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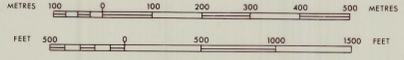
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**KING ISLAND**

KING ISLAND SCHEELITE LTD.

SCALE 1 : 5,000



JUNE 1970

SHEET INDEX

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CO-ORDINATE SYSTEM IS THE INTEGRATED CO-ORDINATE SYSTEM BASED ON AUSTRALIAN GEODETIC DATUM.

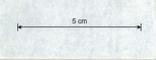
LEVEL DATUM IS MEAN LOW WATER ORDINARY SPRING (RAIN) AS ESTABLISHED BY H.M.S 'TALLAROOK' 1949.

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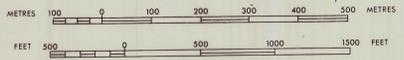
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**KING ISLAND**

KING ISLAND SCHEELITE LTD.

SCALE 1:5,000



JUNE 1970

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| 6512 | 6516 | 6520 |
| 6012 | 6016 | 6020 |

CO-ORDINATE SYSTEM IS THE INTEGRATED CO-ORDINATE SYSTEM BASED ON AUSTRALIAN GEODETIC DATUM.

LEVEL DATUM IS MEAN LOW WATER ORDINARY SPRING (RAN) AS ESTABLISHED BY H.M.S 'TALLAROOK' 1949.

COMPILED BY VALLENTINE, LAURIE & DAVIES FROM AERIAL PHOTOGRAPHY (TASMANIAN LANDS DEPT.) FLOWN IN 1967. SCALE OF 1:32,500

70 0676

1:5000