

23 January 2006

Private Mail Bag 27
Kalgoorlie
Western Australia 6433
T +618 9022 1100
F +618 9022 1119
ABN 97 009 377 619
www.superpit.com.au

**YOUR FEEDBACK IS INVITED – FIMISTON TAILINGS STORAGE FACILITIES
VEGETATION MONITORING PROGRAMME REVIEW**

In September 2005 KCGM released the Seepage and Groundwater Management Plan (SGMP) to oversee the planning and management activities associated with controlling groundwater around the Fimiston I and Fimiston II TSFs.

The primary focus of the SGMP is groundwater level management around the TSFs to protect vegetation. This requires the depth to groundwater to be maintained sufficiently deep so as not to impact on the soils or roots from which plants source water.

To confirm that the SGMP is protecting the environmental value of the area (i.e. vegetation), KCGM undertakes a photographic vegetation monitoring programme around the Fimiston I and Fimiston II tailings storage facilities (TSFs).

KCGM committed to a professional review of the existing vegetation monitoring programme surrounding the Fimiston TSFs as part of the SGMP. This ensures that the monitoring programme adequately represents vegetation surrounding the Fimiston TSFs.

The following report presents the findings of the vegetation monitoring programme and is available for public review and feedback. We encourage the community to take an interest and provide feedback regarding this report.

We would appreciate your feedback by Monday 13 February 2006.

How Can I See the Fimiston TSFs Vegetation Monitoring Review?

Copies of the report are available at the:

- Department of Environment (Kalgoorlie Office)
- KCGM website - www.superpit.com.au
- Super Pit Shop at 2 Burt Street, Boulder

A printed version is also available upon request from the Super Pit Shop at 2 Burt Street, Boulder or contact us via the Public Inquiry Line on 9022 1100.

Why Provide Feedback?

Feedback is an important way for you to provide information, express your opinions and put forward any suggestions for an alternative course of action. It is an opportunity for you to indicate any suggestions you may have to improve the proposed plan. All feedback received by KCGM will be acknowledged and any feedback may be quoted in full or in part in reports.

How Can I Provide Feedback?

There are a number of avenues for you to respond, please participate in the way you would feel most comfortable. To ensure any issues that you may have are clearly understood we encourage the provision of written feedback.

Public Inquiry Line	Accounts	Employee Relations	Open Pits	Fimiston Mill	Gidji Roaster	Supply
T 9022 1100	T 9022 1162	T 9022 1184	T 9022 1800	T 9022 1484	T 9022 1602	T 9022 1358
F 9022 1190	F 9022 1119	F 9022 1189	F 9022 1855	F 9022 1411	F 9022 1610	F 9022 1378



Public Inquiry Line and Email

The KCGM Public Inquiry Line is available 7 days a week, 24 hours a day. Your query will be responded to personally by a KCGM representative. Please phone 9022 1100 or email pil@kalgold.com.au.

Super Pit Website

The Super Pit website is a great information resource, and it is also another way to pass your comments back to KCGM. Visit us at www.superpit.com.au.

Super Pit Shop

Come in and visit our Public Relations team. You will be provided with the most up to date information, and if our PR team can't answer your specific questions, they can arrange for you to speak to the most appropriate KCGM people for your query.

2 Burt Street, Boulder WA 6433, phone 9093 3488 or fax 9093 2488.

Letter

KCGM Senior Environmental Coordinator
Private Mail Bag 27
Kalgoorlie WA 6433

Community Reference Group

You may feel more comfortable talking with one of our Community Reference Group Members, who can get in touch with KCGM on your behalf (anonymously if you prefer). Contact details of the KCGM CRG members are below.

Kathleen Bentley - 0418 947 679
Guy Brownlee - 9021 3888
Murray Joyce - 9021 4262
Peter Lilly - 9088 6001
James Murphy - 9021 8128
Faun McGowan - 0409 115 748

Deborah Botica - 0423 264 016
Ashley Johns - 0419 941 068
Brian Kane - 9080 5836
Anne Petz - 0407 990 019
Kevin Smallhorn - 9021 2420

Department of Environment

Alternatively, if you would prefer to provide any written feedback directly to the Department of Environment (DoE), please feel free to contact Mr Wayne Astill, Program Manager – Goldfields.

Viskovich House 377 Hannan Street, Kalgoorlie, WA 6430, phone 9026 2222 or fax 9021 3529.

When Should Feedback Be Sent?

The closing date for feedback is Monday 13 February 2006.

Please feel free to contact us at any stage to discuss any queries you may have about this Report or any other aspect of our operations at the Super Pit Shop at 2 Burt Street, Boulder or via the Public Inquiry Line on 9022 1100.

Yours Sincerely
Kalgoorlie Consolidated Gold Mines Pty Ltd

COBB JOHNSTONE
GENERAL MANAGER



Review of Vegetation Monitoring
Surrounding Fimiston I and Fimiston II
Tailings Storage Facilities
For
Kalgoorlie Consolidated Gold Mines

Final

December 2005

Prepared by:
Jim's Seeds, Weeds & Trees Pty Ltd
PO Box 2027
Boulder WA 6432

Table of Contents

1	Introduction	2
2	Aims	2
3	Methods	3
4	Findings	4
5	References	5

Appendices

- Appendix 1: Landscape Function Analysis (LFA) and Traditional Monitoring Methods
- Appendix 2: Existing Vegetation Monitoring Program
- Appendix 3: Proposed Additional Vegetation Monitoring Sites
- Appendix 4: Revised Vegetation Monitoring Program

1 Introduction

In 1999 Kalgoorlie Consolidated Gold Mines (KCGM) established a vegetation monitoring programme consisting of 17 transects with 32 photo points around the Fimiston Tailings Storage Facilities (TSFs). The objective of this vegetation monitoring programme is to look for vegetation impact that may be related to changes in groundwater levels in the immediate vicinity of the TSFs.

In August 2004, the Thompson and Brett report stated that a number of trees in the vicinity of the TSFs appeared either stressed or recovering from stress, with many showing epicormic sprouting. The cause of this stress was considered unknown but salt stress was a possible factor based on historical groundwater levels.

On advice from the Minister for Environment, KCGM developed a Seepage and Groundwater Management Plan (SGMP) in September 2005, which outlines the objectives and tasks for the management of seepage and groundwater surrounding the Fimiston TSFs. This SGMP outlines the existing vegetation monitoring programme which involves photographic monitoring. The SGMP also committed to engaging a suitably qualified professional to review this monitoring programme to ensure that it adequately represents vegetation surrounding the Fimiston TSFs.

While the current photographic monitoring methodology and assessment is deemed appropriate, it is recommended to increase and extend the photographic monitoring around the perimeters of the Fimiston TSFs. This increase is to ensure that a uniform representation of vegetation health that surrounds the TSFs is obtained, and that there is no bias towards one side of the TSFs fringe.

Given the nature of the position of Fimiston I TSF, the southern fringe cannot be monitored as this area is occupied by waste rock dumps and so no natural vegetation occurs there. To the west is a rehabilitated area upon which, it is proposed to extend the waste rock dumps and so no additional vegetation monitoring is proposed in this area.

2 Aims

Currently, monitoring of vegetation in the general area of the TSFs exists as photographic monitoring between the eastern side of Fimiston I TSF and western side of Fimiston II TSF where a natural floodway exists (Appendix 2). This monitoring is carried out on an annual basis. It is the aim of this review to determine if the current vegetation monitoring adequately represents the health of vegetation surrounding the Fimiston TSFs to ensure that the environmental value of the area is being protected.

It is anticipated that the recommendations of this review will ensure that the current monitoring will be conducted in conjunction with the proposed monitoring. This report will merge previous photographic monitoring points with new photographic monitoring points and new LFA monitoring points.

Current photographic monitoring is deemed adequate although it is recommended to introduce additional photographic monitoring points. These proposed photographic monitoring points will ensure adequate monitoring of vegetation at the specified distances from the TSF, and to determine the extent of any possible impact caused by seepage or a rising water table.

These additional photographic monitoring points will also ensure that a uniform representation of vegetation health that surrounds the TSFs is obtained, and that there is no bias towards one side of the TSFs fringe.

3 Methods

Vegetation monitoring is undertaken by mining companies to assess the success of rehabilitation and any adverse affects of mining activities to natural vegetation within or surrounding the mine workings.

As part of this review a desktop study has been completed on the available methods of vegetation monitoring to determine if those currently used are adequate. Three types of vegetation monitoring techniques are undertaken at KCGM, via photographic means, LFA monitoring in rehabilitated areas and sulphur dioxide monitoring (Gidji Roaster).

Photographic monitoring is currently undertaken at KCGM between the eastern side of Fimiston I TSF and western side of Fimiston II TSF. KCGM established 32 points in 1999, with wooden pegs set up to mark the position of each photograph. The photographic positions were chosen to depict the vegetation associated with the natural floodway oriented north-south, situated immediately west of Fimiston II TSF (Appendix 2).

The current photographic monitoring is conducted annually by a professional photographer in a systematic order to produce a uniformly ordered set of photographs. All photographs are taken in a specific order and positioned in the same location as the previous year to ensure that the vegetation in each photographic frame is uniformly positioned.

These photographs are then viewed by an experienced environmental professional in accordance with DoE Licence 6420/10, and used to assess the health of the vegetation. Any change in vegetation health can be obtained via any obvious visual signs of vegetation stress or improvement depicted in the photographs.

Using the same methodology, it is recommended that additional photographic monitoring transects should be established, in order to ensure that a uniform representation of vegetation health that surrounds the TSFs is obtained. The proposed additional photographic monitoring transects are depicted in Appendix 3. These suggested locations should have photographic points situated every 100m along the transect directed 300m away from its associated TSF. The direction of each photograph is outlined in Appendix 3.

Proposed locations of the monitoring transects (1-3 & 14) around Fimiston I TSF and monitoring Transects (4 -13) around Fimiston II TSF (Appendix 3) will be placed at or near additional groundwater monitoring bore sites established as part of the SGMP.

Besides photographic monitoring there are a few methods which can be used to monitor vegetation health; one method which is widely accepted is Landscape Function Analysis (LFA). Further information regarding LFA is provided in Appendix 1. LFA monitoring is currently conducted over a series of rehabilitated areas on KCGM's site but is not currently utilised for the monitoring of natural vegetation. Therefore as a second proposal it is recommended that LFA monitoring transects be implemented around the Fimiston TSFs. Vegetation should be monitored at these sites via LFA methods in order to support the visual photographic monitoring, and provide additional scientific data to record any changes in vegetation health.

LFA should be conducted on each of the newly proposed photographic monitoring transects (Appendix 3) and monitoring will depict trends of vegetation health via LFA data, vegetation density, richness and canopy cover.

The values obtained via LFA monitoring will subsequently be compared to values obtained from previous years, in order to depict any trends in vegetation health change.

Analogue (or Control) sites have also been selected via bores established as part of the SGMP, and are situated sufficiently north of the TSFs, where vegetation and groundwater levels are not affected by KCGM's mining activities. The field procedure for analogue sites is the same as for the monitored sites. The selection and use of analogue sites is crucial to the effective use of LFA. Data from these sites provide target values for the LFA indices obtained from the monitoring transects on KCGM's Fimiston Operations

LFA vegetation monitoring should take place on a 6 monthly basis.

4 Findings

The review of the Fimiston TSFs vegetation monitoring program, illustrates that the program has historically been focussed only on vegetation in the natural floodway area. This monitoring occurs between the eastern side of Fimiston I TSF and western side of Fimiston II TSF, via photographic means.

The current monitoring methods and assessment is deemed to be an adequate technique for the areas that are currently monitored, although it is recommended that the same photographic technique be extended to cover vegetation surrounding the entire Fimiston II TSF and the north, east and north-west fringes of Fimiston I TSF. This expanded monitoring programme will ensure that a uniform representation of vegetation health that surrounds the TSFs is obtained, and that there is no bias towards one side of the TSFs fringe. It is also recommended that LFA monitoring be implemented in conjunction with the current and proposed photographic monitoring to give a more robust assessment of vegetation health.

LFA gives additional information to assess vegetation condition and provides a scientific data component. LFA monitoring in conjunction with existing and proposed photographic monitoring will improve the quality and quantity of monitoring relating to vegetation surrounding the KCGM TSFs, which will help to demonstrate the effectiveness of the KCGM's SGMP to protect the environmental value of the area.

The combined current and proposed vegetation monitoring program is depicted in Appendix 4.

5 References

Tongway, D. and Hindley, N. (2004), *Landscape Function Analysis: Procedures for Monitoring and Assessing Landscapes with special reference to Mine sites and Rangelands*. CSIRO WA.

KCGM (2005), *Fimiston Operations Seepage and Groundwater Management Plan*, KCGM

Brett, D., (2004), *Independent Review of a Proposal to Raise the Fimiston I Tailings Dam at Kalgoorlie*, Thompson & Brett Consulting Engineers Pty Ltd.

Appendices

Appendix 1: Landscape Function Analysis (LFA) and Traditional Monitoring Methods

Landscape Function Analysis (LFA)

Landscape Function Analysis (LFA) is a monitoring procedure developed in the 1970's by David Tongway that uses rapidly acquired field-assessed indicators to assess the biogeochemical functioning of landscapes at the hill slope scale. The method is a synthesis of much published material from a variety of sources and is based mainly on processes involved in surface hydrology: rainfall, infiltration, runoff, erosion, plant growth and nutrient cycling. The method not only assesses the ongoing health of vegetation, but also identifies deficient aspects, focussed mainly on soil and landscape suitability, and offers remedial solutions to these.

LFA monitoring has been applied on the KCGM site since 2002, and involves assessing the soil conditions of sloped landforms. This method does not replace the traditional botanical methods of monitoring vegetation but adds a functional interpretation to link vegetation structure and organisation more closely with soil function. LFA monitoring assesses three categories of soils;

- **Stability** - Defined as the ability of the soil to withstand erosive forces, and to reform after disturbance.
- **Infiltration** - Defined as how the soil partitions rainfall into "soil-water" (water available for plants to use), and "runoff water", which is lost from the local system, or may also transport materials (soil, nutrients and seed) away.
- **Nutrient cycling** - Defined as how efficiently organic matter is cycled back into the soil.

LFA relies upon comparisons to analogue sites which depict similar shaped landforms not impacted by mining, as well as the continual comparison to previous assessment results. A minimum of 6 years monitoring as recommended by Tongway (2004) is necessary to depict any substantial changes in these three indicators. Generally an increase in nutrient cycling will represent an improvement in vegetation health and a decrease in will represent deterioration in vegetation health. Additionally any change to the remaining two indicators will represent a change in the soil condition affecting the vegetation health. Generally overall, a decrease in these indicators will signify a decrease in vegetation health and an increase will signify an increase in vegetation health. The three indicators vary independently of each other and combination of increases and decreases in these values will suggest a more complex situation occurring.

Traditional Monitoring Methods

Traditional botanical methods of vegetation monitoring applied at the same time as LFA monitoring, facilitates and supports the outcome of LFA monitoring, by revealing results such as species richness, diversity, and percentage canopy cover, giving direct results as to the growth rate and health of the vegetation. Together with LFA monitoring, gives an enhanced knowledge of the ecosystem function and a comprehensive understanding of vegetation health, and is essential to understanding trends in the health of vegetation.

Appendix 2: Existing Vegetation Monitoring Program

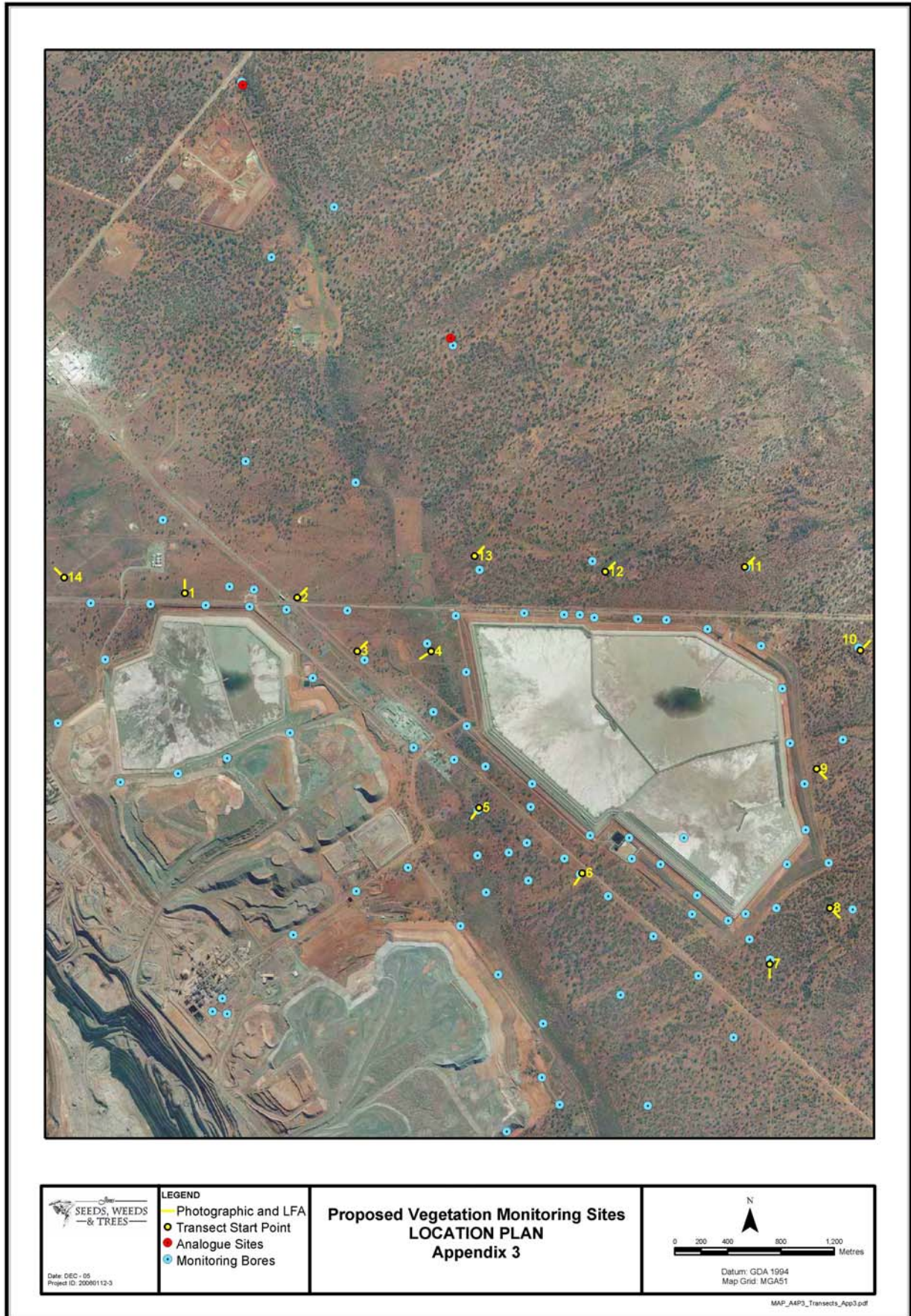
Transect	Origin (Bore)	Sequence of Bores	Photographic Monitoring
A	NTD 1 (n)	MB F1 (n;s)	√
B	NTD 2 (w)	MB F4 (n;s)	√
C	NTD 2 (nw)	MB F6 (e;w) MB F5 (se)	√
D	NTD 3 (w)	AMG (358537:6597384) (e)	√
E	NTD 4 (nw)	AMG (358884:6597023) (e)	√
F	NTD 4 (sw)	MB F32 (e;w), NEVES DAM (e;w)	√
G	NTD 5 (sw)	MB F24 (e)	√
H	NTD 5 (sw)	MB F19 (sw;ne), MB F33 (w;e), MB F31 (w;e)	√
I	NTD 6 (sw)	MB F54 (w;e)	√
J	MB F51 (sw)	MB F55 (sw;ne)	√
K	MB F50 (sw)	MB F56 (sw;ne)	√
L	MB F48 (sw)	MB F57 (sw;ne)	√
M	MB F46 (sw)	MB F47 (n;s;e;w)	√
N	MB F46 (e)	MB F45 (n;s;e;w)	√
O	MB F30 (n;s;e;w)		√
P	MB F26 (e)		√
Q	MB F25 (e)		√

Note: The direction of the photographs is bracketed, and in italics, next to the groundwater bore number. A semicolon separates multiple photographs at one photopoint. Where a monitoring bore is not present the AMG coordinates are given. The numbering system used for photographs below is, for example, A1 where A is the transect and 1 is the origin bore. Successive photograph points, along a transect, are numbered left to right from Table 1.



Appendix 3: Proposed Additional Vegetation Monitoring Sites

Transect	Coordinates (GDA94 51J)		Photographic Transect Direction	Proposed Photographic Monitoring	Proposed LFA Monitoring
	mE	mN			
1	357230	6598237	N	√	√
2	358075	6598205	NE	√	√
3	358526	6597800	NE	√	√
4	359082	6597799	W-SW	√	√
5	359443	6596620	SW	√	√
6	360218	6596126	SW	√	√
7	361629	6595441	S	√	√
8	362081	6595864	SE	√	√
9	361982	6596912	SE	√	√
10	362310	6597806	NE	√	√
11	361441	6598436	NE	√	√
12	360392	6598399	NE	√	√
13	359408	6598518	NE	√	√
14	356322	6598356	NW	√	√
Analogue 1	359228	6600158	-	x	√
Analogue 2	357667	6602068	-	x	√



Appendix 4: Revised Vegetation Monitoring Program

Transect	Associated Bore	Photographic Direction	Photographic Monitoring	LFA Monitoring
A	NTD 1	N	√	x
B	NTD 2	W	√	x
C	NTD 2	NW	√	x
D	NTD 3	W	√	x
E	NTD 4	NW	√	x
F	NTD 4	SW	√	x
G	NTD 5	SW	√	x
H	NTD 5	SW	√	x
I	NTD 6	SW	√	x
J	MB F51	SW	√	x
K	MB F50	SW	√	x
L	MB F48	SW	√	x
M	MB F46	SW	√	x
N	MB F46	E	√	x
O	MB F30	N:S:E:W	√	x
P	MB F26 (e)	E	√	x
Q	MB F25 (e)	E	√	x
1	PBF111 (near)	N	√	√
2	MBF81 (near)	NE	√	√
3	MBF 82 (near)	NE	√	√
4	MBF6 (near)	W-SW	√	√
5	MBF83	SW	√	√
6	PBF82	SW	√	√
7	MBF79	S	√	√
8	MBF78 (near)	SE	√	√
9	PBF112	SE	√	√
10	MBF76	NE	√	√
11	MBF75	NE	√	√
12	MBF1	NE	√	√
13	MBF4 (near)	NE	√	√
14	MBF72 (near)	NW	√	√
Analogue 1	MBF74	-	x	√
Analogue 2	MBF80	-	x	√

