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REPORT - APPENDICES

Public Environmental Report for
Merlin Diamond Project

Prepared for
Ashton Mining Limited

DAMES & MOORE
Ref.: SEB: 23720-009-073/Rep054.Rev0/DOC/DRW
Report No.: 54
20-June-1997

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LIST OF APPENDICES - VOLUME 2

APPENDIX A

MERLIN PROJECT

GUIDELINES FOR THE PREPARATION OF A PUBLIC ENVIRONMENTAL REPORT

Executive Summary

The executive summary should provide an overview of the project including the size and regional importance of the mine, a broad indication of the anticipated production, value of the project to the economy, a summary of the key environmental and socio-economic issues and how they will be managed to keep the level of impacts acceptable to the community.

1. General Description and Summary of Environmental Issues

Brief Introduction of the Proponent and the Proposal :

- Name and Address of the proponent, including contact officers.
- Outline of the proposal.
- Tenement status for the project area, including a suitable map showing existing and proposed tenements held by the proponent.
- Summary of key environmental issues.
- Summarise scope, purpose and structure of the PER.

2. Description of the Proposed Development

This section should describe the project in sufficient detail to allow an understanding of all stages of the proposal, and assist in determining potential environmental impacts. For clarity, the proposal should be discussed under the following headings which reflect the specific nature of this operation. Where appropriate indicate any potential alternatives:

- Location and layout, including land requirements, transport and access corridors.
- Timetable for operations, including development of associated infrastructure, land clearing, construction, extraction operations and haulage.
- Temporary construction requirements including material, sources, transportation, storage and uses.
- Permanent construction requirements including material, sources, transportation, storage and uses.

Mining Development and Operations

- A description of the regional and local geology.
- A description of the pits' mineralisation.
- Outline the proposed design and dimensions of pit(s). Indicate location on suitable site map(s), plan(s) and geological cross-sections.
- Describe mining methods, quantity, scale of operations and extraction schedule(s).
- Detail drilling and blasting requirements (including frequency).
- Outline the scope for any possible future extension of the project.
- Indicate extent of area to be cleared of vegetation and erosion control measures.
- Describe borrow material requirements, identify suitable availability and suitability of material, extraction and uses.

Process and Products

- Describe source of ore, average grades of ore, and quantities of ore to be mined.
- Characterise the ore (including sampling methodology, mineralogy, neutralising capacity, sulphide content as percentage of sulphur, and net acid production potential).
- Describe plant infrastructure and processes that may be required at the processing site.
- Identify all inputs and outputs (products) of the operation and treatment processes.

Waste Rock Dumps and Stockpiles

- Describe volumes, dimensions and shape of dumps or stockpiles.
- Indicate proposed locations, discuss alternatives and reasons for choices. Describe water catchments, contingency acid rock drainage interception arrangements, surface water treatment and final landform of dumps and stockpiles.
- Outline sampling criteria and test methods for waste rock characterisation, identify possible chemical constituents in drainage.
- Describe in detail the methods for waste rock disposal and dump construction, including selection methodology and on-going characterisation of different waste rock types for disposal, selective handling of different waste types, and cross sections or the design of the waste rock dumps.
- Characterise the waste rock (including sampling methodology, mineralogy, base metal content, acid neutralising capacity, sulphide content as percentage of sulphur, net acid generation (NAG), net acid production potential (NAPP)).

Tailings

- Describe the construction details of all tailings containment structures including materials, sources and transportation.
- Describe the means of disposal and control of any potential acid mine drainage.
- Describe the physical and chemical characteristics of the tailings and supernatant waters.

Water Management

- Outline water requirements and indicate proposed sources and methods of supply.
- Describe requirements and techniques for pit de-watering and waste rock water catchment strategies, including expected quality and quantities before and after decommissioning and outline strategies for dealing with flood or storm drainage.
- Prepare a water balance for the site.
- Identify on-site catchments and drainage patterns.

Infrastructure

- Outline administration, staff amenity and workshop buildings.
- Describe explosive storage and transport.
- Describe hazardous substances (types, storage, use, transport and disposal).
- Describe fuel, oil and lubricants (types, storage, transport and disposal).
- Describe alternatives for power supply (eg transmitted power), infrastructure, servicing easements and indicate preferred options.
- Describe sewerage and refuse disposal requirements.
- Describe communication and security arrangements.

Road Access

- Indicate any requirements for construction and/or upgrading of existing road services. Include the design of stream crossings and erosion control measures. Outline on maps.

Workforce

- Provide estimates of number required during construction, operation and rehabilitation, and outline employment opportunities from the local community.
- Outline health, safety and emergency procedures.
- Outline programmes to educate employees in relation to their environmental, heritage and sacred site protection obligations.
- Describe accommodation, office and transportation requirements for staff.

3. Description of the Existing Environment

This section should describe those elements of the existing environment that may or have the potential to be affected by this proposal.

Biophysical Environment

- Climate including summary data of rainfall, evaporation rates and temperatures (monthly averages).
- Description of topography, geology and soils at all project sites (including maps). Information should include land unit characteristics.

Hydrology

- Describe surface water hydrology and local catchment areas.
- Outline surface water quality and sediment load characteristics.
- Describe and characterise local and regional groundwater occurrences, quality, interaction with surface processes, seasonal variations and any present uses.

Flora and Fauna

- Describe flora and fauna communities for immediate area and surrounds (including communities downstream of the site which may be impacted by variations in water quality and siltation); include maps and an outline of methodology used to gather information, survey and sampling techniques.
- Identify any unique, rare, endangered or vulnerable native species or communities at and in the vicinity of project area, access roads and infrastructure in relation to overall status, distribution and condition, and in particular include species listed under the *Territory Parks and Wildlife Conservation Act* and the *Endangered Species Act* (Commonwealth).
- Describe the feral animal and weed species populations in the area.
- Provide baseline data on mosquito and other biting insect habitats and populations (nature of breeding site(s) and species eg. exotic and endemic) and potential for disease transmission.
- Evaluate normal ambient noise levels adjacent to the proposed mineral leases area.
- Describe the fire regime.

Socio-economic Environment

- Describe current land tenure and land use in and adjacent to the project area including Aboriginal land use; indicate any past land degradation or alteration that may have occurred.
- Describe nearby communities (eg Borroloola) and any other physical infrastructure (ie. roads) that could be affected by construction and operation activities.
- Provide results from a survey to determine sites of heritage significance within the project area and access road(s) pursuant to the *Heritage Conservation Act:*
  -include details of survey methodology and sampling techniques;
  -include site descriptions, diagrams and maps; and
  -include an assessment of significance in a regional context.

- Provide evidence of an Authority Certificate under the Northern Territory *Aboriginal Sacred Sites Act*. The results of an inspection of the Register of Sacred Sites maintained by the Aboriginal Areas Protection Authority, as well as details of an application lodged with the Aboriginal Areas Protection Authority for an Authority Certificate within the meaning of Part 3, Division 1 of the Northern Territory *Aboriginal Sacred Sites Act*. Also, if practicable, include a copy of the Certificate issued by the Authority as a result of that application containing conditions (if any) relating to the protection of sacred sites on, or in the vicinity, of the project area.

4. Environmental Impacts and Proposed Safeguards

This section should describe actual and potential environmental impacts of the project, along with the environmental management practices or safeguards proposed to avoid, minimise or ameliorate impacts for all stages of the project.

Management practices or safeguards should be expressed as a series of commitments. These commitments and any associated discussion of impacts should be arranged in appropriate sections and subsections. Each commitment should be numbered consecutively and highlighted to stand out from the surrounding text.

Impacts and Safeguards

Impacts may be direct, indirect, short or long term, temporary or irreversible. They may occur during all stages of the project, including construction, operation, decommissioning and rehabilitation. All potential impacts should be identified and characterised in this manner. Information on the risk, scale and significance of each impact should also be included.

Measures proposed to mitigate the adverse impacts associated with the proposal and, where appropriate, alternatives should be included.

A description of environmental impacts and safeguards should address the following:
(The level of detail presented in this section should reflect the degree of significance of potential impacts.)

- Soil erosion, landform and land clearing.

- Impacts of any changes in surface water quality and quantity, both at the mine site and downstream, on:

  - flora and fauna including toxicity, bio-accumulation and any impacts on food chains;
  - existing water supplies; and
  - runoff, erosion and surface drainage system effects including sediment load.

- Impact on ground water quality and quantity and the impact of any changes that may occur at the mine site and off-site, including effects on beneficial users.

- Impact on flora and fauna through:

  - loss of habitat;
  - earthworks, erosion;
  - alteration to drainage and groundwater regimes;
  - creation or exacerbation of weed and feral animal population (including biting insects and refer to the NT Weeds Management Strategy 1996-2005); and
  - changes in frequency of bush fire regime during operation and post mining.

- Impacts on heritage, archaeological sites and sacred sites.

- Impact on any local communities and adjacent land use (including other mining, pastoral land use, Aboriginal communities, transport corridors, recreation and tourism).

- Impact on human health through:

  - potable water and food sources;
  - mosquitoes and other biting insects;
  - sewage and refuse disposal;
  - air quality (dust and atmospheric emissions); and
  - noise levels (blasting and extraction operations).

- Visual aesthetics.

Site Rehabilitation

In describing environmental management practices and safeguards, particular attention should be given to site rehabilitation. The following matters should be addressed:

- Objectives of site rehabilitation and expected future land use. Discuss the possible final landforms. A time scale for decommissioning and rehabilitation should be outlined. Rehabilitation should be conducted progressively throughout the project operation where ever practicable.

- Describe progressive and/or final rehabilitation plan, including maintenance of water quality.

- Design of all rehabilitated land forms to minimise erosion and acid drainage.

- Natural and constructed drainage system design to ensure runoff discharge does not erode or add to downstream siltation.

- Covering of waste rock dumps including details of quality, depths and quality of cover material.

- Topsoil management/use.

- Actions to prevent the development of mosquito and other biting insect breeding habitats.

- Establishment of vegetation, including selection of plant species (eg. for runoff and erosion control and prevention of leaching), seeding, fertiliser use (if needed) and rehabilitation trials.

- Continued water monitoring and discharge requirements following decommissioning.

Summary Table

Provide a summary table listing in point form those environmental impacts identified for the projects and the corresponding management commitments to deal with them. Responsibilities for monitoring and response mechanisms should be outlined.

5. Environmental Monitoring

Environmental monitoring should be compatible with baseline studies, however, they should be identified separately.

Environmental monitoring should be directed to and address each key environmental issue and management activity and include the following objectives:

(a) Detect long and short term trends.
(b) Recognise environmental changes and enable analysis of their causes.
(c) Measure impacts.

It is required that details of proposed monitoring programs and objectives under the following headings be provided:

- Monitoring objectives.
- Program of sampling (eg. include water, waste rock, revegetation, flora and fauna (aquatic and terrestrial)).
- Location and description of sampling sites (include map).
- Sampling and reporting frequency and methodologies, including proposed detection limits.
- A table providing details of the original and on-going baseline studies and monitoring programs is recommended.
- Review of monitoring programs and objectives.

6. References and Appendices

Include a list of references where referred to in the text.
Appendices should include reports of all studies undertaken for preparation of the report or other information sources.

7. Administrative Requirements

- Once the PER is ready for comment, 30 copies should be submitted to the Department of Mines & Energy for distribution to NT Government advisory bodies.

- Two copies of a "preliminary" PER should be lodged with the Department of Lands, Planning and Environment and the Department of Mines and Energy for perusal prior to release for the public review period.

- Arrangements for the public display and review, including locations and number of copies will be made at the time when the preliminary copy of the draft EIS is reviewed. It is the responsibility of the proponent to advertise the public availability of the PER for public comment.

- Please arrange lodgment of a computer disc copy of the PER with the Department of Lands, Planning and Environment.

- The Department of Lands, Planning and Environment action officer for this project is Mr Helge Pedersen. Phone (08) 8924 4138, Fax (08) 8924 4053.

- The Department of Mines and Energy action officer for this project is Mr Mark Nolen. Phone (08) 8999 5343, Fax (08) 8999 5191.

APPENDIX B

EGi
ENVIRONMENTAL
GEOCHEMISTRY
INTERNATIONAL
Stuart D Miller
MANAGING DIRECTOR

Our Reference: 6850/318

ATTENTION	:	Michael Bohm
COMPANY	:	Ashton Mining - Merlin Project
FROM	:	Stuart Miller
SUBJECT	:	Geochemical Characterisation of Waste Rock and Ore
DATE	:	23 June 1997
PAGES (including this page)	:	9

Michael,

This technical memorandum presents our interpretation of the waste rock and ore geochemical data provided to Environmental Geochemistry International Pty Ltd (EGi) by Ashton Mining. The data provided form a geochemical assessment of waste and ore material from the Merlin Project, Northern Territory. The samples have been assayed for their acid forming characteristics and multi-element content and the results are appended to this memorandum. All the test work in this instance had been carried out, under the direction of Ashton Mining, by Genalysis Laboratory Services Pty. Ltd, Perth.

Acid Forming Characteristics

The results of the acid forming characteristics are presented on Table 1 along with a description of the samples. Below is a summary and our interpretation of these results.

- The samples were analysed for - total sulphur (S-tot), sulphate sulphur ($S\text{-}SO_4$), and sulphide sulphur (sulphides) concentrations. All results are reported as %S. The total S and $S\text{-}SO_4$ were analytical determinations with the sulphide sulphur values determined by the calculated difference between the total S and the sulphate sulphur concentration for each sample. The calculated sulphide sulphur provides a better assessment of the acid potential of a sample since sulphate sulphur is non-acid generating. The results show that all samples had calculated sulphide values at or less than the detection limit (0.01 % S). The maximum potential acidity (MPA) from this sulphur content is very low (less than 0.3 kg H_2SO_4/t).

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- The acid neutralising capacity (ANC) of the waste samples were very low with values less than 2.5 kg H_2SO_4/t and a median value of 0.5 kg H_2SO_4/t. Three of the ore samples had high ANC's with values of 515, 265 and 221 kg H_2SO_4/t for PK4, EK3, and SK2 respectively with the remaining samples having low to moderate ANC values (3.4 to 14.7 kg H_2SO_4/t).

- Based on the ANC and sulphide values the net acid producing potential (NAPP) was calculated for all samples. The NAPP value represents the balance between a samples capacities to generate acid and to neutralise acid. A positive NAPP indicates that the acid potential exceeds the neutralising capacity and a negative NAPP indicates that there is an excess of neutralising capacity over acid potential. The results on Table 1 show that for waste rock samples the NAPP values were zero or slightly negative while the ore samples were strongly negative indicating that all samples are likely to be non-acid forming.

- The waste samples had final NAGpH values between 4.9 and 6.0 and the ore samples had higher NAGpH values between 5.8 and 9.1. A NAGpH greater than or equal to 4.0 classifies a sample as non - acid forming. The results of the NAG test are consistent with the NAPP results and confirm that material represented by the samples tested are classified as non-acid forming (NAF).

The waste samples analysed in this test work had concentrations of total S less than the detection limit and ANC values of less than 2.5 kg H_2SO_4/t. This inherent lack of S and ANC indicates that material represented by these samples are essentially barren in terms of their acid producing potential, i.e. no ability to neutralise or generate acid. Based on these results, the waste rock samples are classified as non acid forming-barren.

The ore samples had little or no reactive sulphides, negative or zero NAPP values and ANC's between 3.5 to 525 kg H_2SO_4/t. Based on these results material represented by the ore samples were classified as non acid forming (NAF) with some samples also classified as acid consuming (AC).

Elemental Composition and Enrichment

Multi-element scans were conducted on all waste and ore samples. The assay results for each sample are presented on Table 2. The elements listed on Table 2 are presented in two groups - 'Environmental Indicators', and 'Rare Earths and Other Metals' to assist with data interpretation. Table 3 presents the Geochemical Abundance Indices (GAI) for each element. Multi-element scans provide information on environmentally significant elements which may be enriched beyond normal background concentrations and the GAI index identifies these elements. The multi-element scans provided covered all our normal range of environmental indicators with the exception of B, F and Hg. It is recommended that these elements are included in any additional multi-element analyses. Generally a GAI value ≥ 3 is considered significant.

There were no environmentally significant elements enriched in the waste rock however, the following elements were significantly enriched in more than one of the ore samples:

Ba, Cr, and Ni.

ANZECC[1] have published guidelines for the assessment and management of contaminated sites. This includes environmental soil quality guidelines for the identification of elements that may require further investigation. Table 3 compares the concentration ranges of the enriched elements in the ore samples with the ANZECC Guidelines for environmental investigation.

Table 3: Element Concentration in ore samples compared to the ANZECC guidelines.

Element	Concentration (mg/kg)	ANZECC Guidelines Environmental Investigation (mg/kg)
Ba	540-6400	no guidelines
Cr	255-1600	50
Ni	430-1900	60

Table 3 shows that the concentration of Cr and Ni in some ore samples significantly exceed the ANZECC guidelines. The enrichment of Cr and Ni are common in Kimberlite intrusions and it is understood that concentrations of around 1,000 mg/kg for Cr and 1,200 mg/kg for Ni are typical in this type of rock[2]. The environmental significance of Cr and Ni will depend on their solubility and leaching characteristics.

Conclusions

The results of this initial testing program indicate that material represented by the waste samples provided would be classified as barren with essentially no potential to generate or neutralise acid. The waste rock samples also contain only low concentrations of environmentally important elements. These results indicate that there are no geochemical concerns for waste rock management for material represented by the samples provided.

The ore samples tested are classified as non-acid forming with some samples having sufficient excess acid neutralising capacity to be considered acid consuming. Some ore samples contained elevated concentrations of Ba, Cr and Ni and it is recommended that the solubility of these elements be investigated to assess their environmental significance.

[1] Australian and New Zealand Environment and Conservation Council & National Health and medical Research Council (1992). Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites.

[2] Best M. G., (1982) Igneous and Metamorphic Petrology, W.H. Freeman & Company, New York.

Boron, fluoride and mercury were not included in the multi-element suite provided. It is recommended that these elements are included in any additional multi-element analysis to confirm their expected low concentrations.

A hard copy of this memorandum and the results will be provided by post. Should you have any questions in regard to this technical memorandum, please call on 02-9810 8100 or fax on 02-9810 5542.

Yours sincerely

Stuart Miller
Managing Director

Table 1: Acid Base Account for samples from the Proposed Merlin Project, Western Australia

Pipe	Sample No.	Description	Location	S-Tot (% S)	S-SO4 (% S)	Sulphides (% S)	ANC° (kg H2SO4/t)	NAPP# (kg H2SO4/t)	NAG value to pH 4.5* (kg H2SO4/t)	NAGpH	Geochemical Classification
Excalibur	EK3	Ore	BH 546 (32.9m to 33.05 & 47.86m to 48.02m)	0.045	0.04	<0.01	265	-265	0	9.1	NAF-AC
	EK10		Bulk sub sample (1996 program)	<0.005	0.02	<0.01	14.7	-15	0	8.6	NAF
	EW8	Waste	BH 546 (28.65m to 28.81m)	<0.005	<0.01	<0.01	1.0	-1	0	5.7	NAF-Barren
	EW16		BH 113 (9m)	<0.005	<0.01	<0.01	0.5	0	0	5.2	NAF-Barren
Launfal	LK1	Ore	BH 545 (19.9m to 20.2m & 30.10 m to 30.25m & 49.67m to 49.85m)	<0.005	<0.01	<0.01	5.9	-6	0	6.9	NAF
	LK11		Bulk sub sample (1996 program)	<0.005	<0.01	<0.01	3.4	-3	0	5.8	NAF
	LW7	Waste	BH 545 (5.89m to 6.04m)	<0.005	<0.01	<0.01	1.0	-1	0	5.0	NAF-Barren
	LW13		Grab sample	<0.005	<0.01	<0.01	<0.5	0	0	5.1	NAF-Barren
	LW14		Grab sample	<0.005	<0.01	<0.01	<0.5	0	0	5.4	NAF-Barren
Palomides	PK4	Ore	BH 541 (21.0m to 21.2m & 22.74m to 22.90m)	<0.005	<0.01	<0.01	515	-515	0	8.6	NAF-AC
	PK9		Bulk sub sample (1996 program)	0.070	0.06	0.01	13.7	-13	0	8.8	NAF
	PW5	Waste	BH 541 (4.7m to 5.2m)	<0.005	<0.01	<0.01	2.5	-2	0	5.2	NAF-Barren
	PW15		Grab Sample	<0.005	<0.01	<0.01	<0.5	0	0	4.9	NAF-Barren
Sacramore	SK2	Ore	BH 543 (24.90m to 25.09m & 49.90m to 50.02m)	<0.005	0.01	<0.01	221	-221	0	8.8	NAF-AC
	SW6	Waste	BH 543 (6.27m to 6.40m)	<0.005	<0.01	<0.01	2.5	-2	0	5.7	NAF-Barren
	SW12		Grab Sample	<0.005	<0.01	<0.01	0.5	0	0	5.5	NAF-Barren

Results have been supplied by Genalysis Laboratory Services Pty Ltd.
*Note: Genalysis represented the NAG values as ≤ 2 kg H2SO4/t. However, by definition, if the NAGpH ≥ 4, the NAG value is zero.
°ANC calculated in units kg H2SO4/t.
#NAPP calculated by EGI as follows: (Sulphide value x 30.625) -(ANC). Sulphide values <0.01 were assumed to contain 0.005 % S.
NAF: Non-acid forming, AC: Acid consuming

Table 2: Multi-element Composition of Ore and Waste Rock samples from the Merlin Project, Western Australia

Elements	Units	Detection Limit	Excalibur Pipe				Launfal Pipe				
			Ore		Waste		Ore		Waste		
			EK3	EK10	EW8	EW16	LK1	LK11	LW7	LW13	LW14
Major Elements			**Environmental Indicators- Assay results in mg/kg unless otherwise specified**								
Al	%	0.002%	2.65%	3.60%	1.08%	2.80%	5.00%	6.40%	1.95%	1.70%	1.40%
Ca	%	0.001%	8.80%	2.55%	0.072%	0.014%	0.120%	0.036%	0.023%	0.011%	0.012%
Fe	%	0.01%	4.30%	15.50%	0.96%	0.98%	6.40%	15.00%	1.04%	0.43%	0.40%
K	%	0.002%	1.80%	0.88%	0.50%	2.90%	2.50%	0.20%	0.22%	1.06%	1.00%
Mg	%	0.002%	5.80%	1.50%	0.12%	0.05%	0.88%	0.80%	0.15%	0.03%	0.03%
Na	%	0.002%	0.072%	0.044%	0.026%	0.094%	0.07%	0.13%	0.03%	0.04%	0.04%
S	%	0.001%	0.06%	0.001%	0.0003%	0.0002%	0.004%	0.007%	0.003%	0.003%	0.002%
Minor Elements											
Ag	mg/kg	0.5	<	<	<	<	<	<	<	<	<
As	mg/kg	2	<	8	<	<	4	<	<	<	<
Ba	mg/kg	1	2050	2550	370	490	5200	6400	245	450	370
Be	mg/kg	0.1	2.0	7.2	1.8	0.4	6.0	16.0	0.8	0.3	0.3
Bi	mg/kg	0.5	<	<	<	<	<	<	<	<	<
Cd	mg/kg	0.5	<	1.0	<	<	<	<	<	<	<
Ce	mg/kg	0.1	460	540	43	19.5	250	780	72	23.5	25
Co	mg/kg	1	82	175	10	2	56	74	<	<	<
Cr	mg/kg	2	740	860	112	82	490	1600	100	110	116
Cu	mg/kg	1	78	125	6	5	64	130	5	5	6
Mn	mg/kg	1	860	5000	47	35	1900	1500	21	17	24
Mo	mg/kg	0.5	2.5	2.5	2.0	2.0	5.0	1.0	2.0	2.0	3.0
Ni	mg/kg	1	1100	1550	29	11	960	980	18	8	7
P	mg/kg	20	5200	1.35%	1080	120	3800	4900	360	320	220
Pb	mg/kg	2	84	100	4	12	22	94	6	12	16
Sb	mg/kg	0.2	0.4	0.8	<	0.4	1.8	1.2	<	0.4	0.4
Se	mg/kg	10	<	<	<	<	<	<	<	<	<
Sn	mg/kg	1	1	2	1	1	2	2	<	<	<
Sr	mg/kg	0.1	280	275	120	49	350	720	68	110	60
Tl	mg/kg	0.2	0.2	0.8	<	0.6	0.4	<	<	<	<
V	mg/kg	2	68	92	18	8	225	175	24	12	10
W	mg/kg	1	2	4	<	2	5	8	<	2	<
Zn	mg/kg	1	84	1000	37	22	340	560	18	8	10
			Rare Earths and Other Metals - Assay results in mg/kg unless otherwise specified								
Au	mg/kg	0.5	<	<	<	<	<	<	<	<	<
Os	mg/kg	0.2	4.0	5.2	1.2	2.4	4.0	3	1.0	1.4	1.4
Dy	mg/kg	0.1	4.0	5.6	3.0	0.6	33	14	2.2	2.5	3.2
Er	mg/kg	0.1	1.8	2.7	1.4	0.4	26	6.4	0.7	1.1	1.2
Eu	mg/kg	0.1	2.5	3.1	0.7	<	3.7	4.8	1.3	0.5	0.4
Ga	mg/kg	1	7	11	3	5	15	14	4	3	3
Gd	mg/kg	0.1	7.8	10	3.7	0.6	15.5	15	5.2	2.9	2.0
Ge	mg/kg	0.5	1.5	2.5	1.0	1.5	1.5	1.5	1.5	1.0	1.0
Hf	mg/kg	0.5	3.0	4.0	1.0	3.5	3.0	4.0	1.5	2.0	2.5
Ho	mg/kg	0.1	0.6	0.9	0.5	<	8.0	2.5	0.3	0.4	0.4
In	mg/kg	0.1	<	<	<	<	<	<	<	<	<
La	mg/kg	0.1	340	390	19.5	11.4	160	620	32	10.8	11.4
Li	mg/kg	0.5	50.0	10.5	7.0	1.5	12.5	6.5	5.0	2.5	2.5
Lu	mg/kg	0.1	0.2	0.3	0.2	<	3.9	0.7	<	0.2	0.2
Nb	mg/kg	0.5	420	470	2.5	2.5	170	580	3.5	2.5	2.5
Nd	mg/kg	0.1	104	125	18.5	5.4	84	180	32	9.4	9.4
Pd	mg/kg	1	<	<	<	<	<	<	<	<	<
Pr	mg/kg	0.1	38	45	4.8	1.9	25	64	8.4	2.5	2.7
Pt	mg/kg	0.5	<	<	<	<	<	<	<	<	<
Rb	mg/kg	0.2	200	84	25.5	112	76	18	13.5	42	40
Re	mg/kg	0.2	<	<	<	<	<	<	<	<	<
Ru	mg/kg	0.5	<	<	<	<	<	<	<	<	<
Sc	mg/kg	2	14	18	<	<	22	28	4	<	<
Sm	mg/kg	0.1	11.0	14.0	3.7	0.7	14.5	20.5	5.8	2.1	1.7
Ta	mg/kg	0.2	15.5	20	<	<	8.6	28	<	<	<
Tb	mg/kg	0.1	0.9	1.2	0.5	<	3.5	2.4	0.6	0.4	0.3
Te	mg/kg	0.5	<	<	<	<	<	<	<	<	<
Th	mg/kg	0.1	88	96	4.3	4.4	39	114	5.6	5.4	6
Ti	mg/kg	5	3400	4100	500	390	6600	5800	640	360	420
Tm	mg/kg	0.1	0.2	0.3	0.2	<	4.0	0.8	<	0.2	0.2
U	mg/kg	0.1	5.4	6.8	1.9	1.1	11.4	13.5	0.7	1.3	1.5
Y	mg/kg	0.1	16.5	27	17	3.1	280	80	6.8	11	10.8
Yb	mg/kg	0.1	1.1	1.9	1.1	0.7	25.0	4.3	0.7	1.0	1.2
Zr	mg/kg	1	98	150	31	108	104	145	45	64	84

Footnotes
< signifies element at or below detection limit in sample

Table 2 cont'd: Multi-element Composition of Ore and Waste Rock samples from the Merlin Project, Western Australia

Elements	Units	Detection Limit	Palomides				Sacramore		
			Ore		Waste		Ore	Waste	
			PK4	PK9	PW5	PW15	SK2	SW6	SW12
Major Elements	**Environmental Indicators- Assay results in mg/kg unless otherwise specified**								
Al	%	0.002%	1.35%	6.60%	1.40%	1.35%	1.80%	1.70%	1.25%
Ca	%	0.001%	16.00%	0.56%	0.066%	0.01%	3.70%	0.048%	0.023%
Fe	%	0.01%	2.55%	13.50%	16.50%	0.34%	3.20%	2.20%	0.40%
K	%	0.002%	0.35%	0.14%	0.23%	0.37%	0.82%	0.23%	0.36%
Mg	%	0.002%	7.20%	1.45%	0.22%	0.01%	9.20%	0.26%	0.05%
Na	%	0.002%	0.08%	0.18%	0.08%	0.02%	0.08%	0.09%	0.02%
S	%	0.001%	<	0.007%	0.005%	0.002%	0.02%	0.005%	0.01%
Minor Elements									
Ag	mg/kg	0.5	<	<	<	<	<	<	<
As	mg/kg	2	<	4	<	<	2	<	<
Ba	mg/kg	1	980	5200	580	295	540	740	760
Be	mg/kg	0.1	0.8	11.4	0.9	0.2	12.5	2.4	0.4
Bi	mg/kg	0.5	<	<	<	<	<	<	<
Cd	mg/kg	0.5	<	<	<	<	<	<	<
Ce	mg/kg	0.1	155	470	54	18.5	155	46	50
Co	mg/kg	1	31	125	3	<	38	2	<
Cr	mg/kg	2	255	1160	160	120	265	130	135
Cu	mg/kg	1	22	135	7	4	31	37	4
Mn	mg/kg	1	780	2000	96	35	660	50	37
Mo	mg/kg	0.5	1.0	5.0	7.0	4.5	3.5	8.0	5.5
Ni	mg/kg	1	430	1200	29	5	1900	22	8
P	mg/kg	20	1080	3000	520	200	1300	1060	640
Pb	mg/kg	2	18	14	6	68	34	6	10
Sb	mg/kg	0.2	0.4	0.8	<	<	0.4	0.6	<
Se	mg/kg	10	<	<	<	<	<	<	<
Sn	mg/kg	1	<	2	<	<	<	<	<
Sr	mg/kg	0.1	490	480	130	26	180	185	285
Tl	mg/kg	0.2	<	<	<	<	<	<	<
V	mg/kg	2	28	130	28	4	38	54	10
W	mg/kg	1	6	19	2	2	6	<	2
Zn	mg/kg	1	34	520	31	5	520	48	10
	Rare Earths and Other Metals - Assay results in mg/kg unless otherwise specified								
Au	mg/kg	0.5	<	<	<	<	<	<	<
Os	mg/kg	0.2	2.0	4.6	0.8	0.4	2.6	1.0	0.6
Dy	mg/kg	0.1	1.7	16.5	8.0	2.0	2.5	13.5	5.4
Er	mg/kg	0.1	0.9	9.2	3.9	1.2	1.3	6.0	2.9
Eu	mg/kg	0.1	0.9	3.6	4.0	0.2	1.1	3.8	0.9
Ga	mg/kg	1	4	14	3	2	5	5	2
Gd	mg/kg	0.1	3.0	13.0	14.5	1.6	3.8	19	5.6
Ge	mg/kg	0.5	1.0	1.5	1.0	1.0	1.0	1.0	1.0
Hf	mg/kg	0.5	1.5	4.0	1.0	1.5	2.0	1.5	1.5
Ho	mg/kg	0.1	0.3	3.2	1.4	0.4	0.4	2.3	1.1
In	mg/kg	0.1	<	<	<	<	<	<	<
La	mg/kg	0.1	114	350	24.5	9.6	110	20	21.5
Li	mg/kg	0.5	88.0	15.5	5.0	4.5	118	6.5	5.5
Lu	mg/kg	0.1	0.2	1.2	0.5	0.2	0.2	0.8	0.4
Nb	mg/kg	0.5	125	480	9.5	2.0	125	3.0	1.5
Nd	mg/kg	0.1	37	110	35	6.4	38	34	22.5
Pd	mg/kg	1	<	<	<	<	<	<	<
Pr	mg/kg	0.1	13.0	39.0	6.8	1.8	13.5	6.0	5.6
Pt	mg/kg	0.5	<	<	<	<	<	<	<
Rb	mg/kg	0.2	41	17.5	13.5	16.5	70	14	15
Re	mg/kg	0.2	<	<	<	<	<	<	<
Ru	mg/kg	0.5	<	<	<	<	<	<	<
Sc	mg/kg	2	6	26	<	<	8	4	<
Sm	mg/kg	0.1	4.3	15.0	14.5	1.3	4.7	14	5
Ta	mg/kg	0.2	5.4	24.0	0.6	<	6.2	<	<
Tb	mg/kg	0.1	0.4	2.4	1.5	0.3	0.5	2.6	0.8
Te	mg/kg	0.5	<	<	<	<	<	<	<
Th	mg/kg	0.1	27	96	5.4	4.2	28	4.7	4.2
Ti	mg/kg	5	1500	5800	660	285	1700	1000	265
Tm	mg/kg	0.1	<	1.2	0.5	0.2	0.2	0.8	0.4
U	mg/kg	0.1	1.8	7.6	1.2	1.3	3.2	3.8	1.6
Y	mg/kg	0.1	7.6	104	39	11.4	11.6	58	30
Yb	mg/kg	0.1	0.7	6.6	3.2	1.1	1.1	5.0	2.4
Zr	mg/kg	1	46	145	32	40	70	56	41

Footnotes
< signifies element at or below detection limit in sample

Table 3: Geochemical Abundance Indices of Ore and Waste Rock samples from the Merlin Project, Western Australia

Elements	Average Crustal Abundance*	Excalibur Pipe				Launfal Pipe				
		Ore		Waste		Ore		Waste		
		EK3	EK10	EW8	EW16	LK1	LK11	LW7	LW13	LW14
Major Elements	**Environmental Indicators - Geochemical Abundance Indices#**									
Al	8.20%	0	0	0	0	0	0	0	0	0
Ca	4.10%	1	0	0	0	0	0	0	0	0
Fe	4.10%	0	1	0	0	0	1	0	0	0
K	2.10%	0	0	0	0	0	0	0	0	0
Mg	2.30%	0	0	0	0	0	0	0	0	0
Na	2.30%	0	0	0	0	0	0	0	0	0
S	0.03%	0	0	0	0	0	0	0	0	0
Minor Elements										
Ag	0.1	0	0	0	0	2	0	0	0	0
As	1.5	0	2	0	0	1	0	0	0	0
Ba	500	1	2	0	0	3	3	0	0	0
Be	2.6	0	1	0	0	1	2	0	0	0
Bi	0.17	1	0	0	0	1	0	0	0	0
Cd	0.2	0	2	0	0	0	0	0	0	0
Ce	68	2	2	0	0	1	3	0	0	0
Co	25	1	2	0	0	1	1	0	0	0
Cr	100	2	3	0	0	2	3	0	0	0
Cu	50	0	1	0	0	0	1	0	0	0
Mn	950	0	2	0	0	0	0	0	0	0
Mo	1.5	0	0	0	0	1	0	0	0	0
Ni	80	3	4	0	0	3	3	0	0	0
P	1000	2	0	0	0	1	2	0	0	0
Pb	14	2	2	0	0	0	2	0	0	0
Sb	0.2	0	1	0	0	3	2	0	0	0
Se	0.05	0	0	0	0	0	0	0	0	0
Sn	2.2	0	0	0	0	0	0	0	0	0
Sr	370	0	0	0	0	0	0	0	0	0
Tl	0.6	0	0	0	0	0	0	0	0	0
V	160	0	0	0	0	0	0	0	0	0
W	1	0	1	0	0	2	2	0	0	0
Zn	75	0	3	0	0	2	2	0	0	0
	Rare Earths and Other Metals - Geochemical Abundance Indices#									
Au	0.001	0	0	0	0	0	0	0	0	0
Os	3.0	0	0	0	0	0	0	0	0	0
Dy	6.0	0	0	0	0	2	1	0	0	0
Er	3.8	0	0	0	0	2	0	0	0	0
Eu	2.1	0	0	0	0	0	1	0	0	0
Ga	18	0	0	0	0	0	0	0	0	0
Gd	7.7	0	0	0	0	0	0	0	0	0
Ge	1.8	0	0	0	0	0	0	0	0	0
Hf	5.3	0	0	0	0	0	0	0	0	0
Ho	1.4	0	0	0	0	2	0	0	0	0
In	0.049	0	0	0	0	0	0	0	0	0
La	32	3	3	0	0	2	4	0	0	0
Li	20.0	1	0	0	0	0	0	0	0	0
Lu	0.5	0	0	0	0	2	0	0	0	0
Nb	20.0	4	4	0	0	3	4	0	0	0
Nd	38	1	1	0	0	1	2	0	0	0
Pd	0.0006	0	0	0	0	0	0	0	0	0
Pr	9.5	1	2	0	0	1	2	0	0	0
Pt	0.001	0	0	0	0	0	0	0	0	0
Rb	90	1	0	0	0	0	0	0	0	0
Re	0.0004	0	0	0	0	0	0	0	0	0
Ru	0.001	0	0	0	0	0	0	0	0	0
Sc	16	0	0	0	0	0	0	0	0	0
Sm	7.9	0	0	0	0	0	1	0	0	0
Ta	2.0	2	3	0	0	2	3	0	0	0
Tb	1.1	0	0	0	0	1	1	0	0	0
Te	0.005	0	0	0	0	0	0	0	0	0
Th	12	2	2	0	0	1	3	0	0	0
Ti	5600	0	0	0	0	0	0	0	0	0
Tm	0.5	0	0	0	0	2	0	0	0	0
U	2.4	1	1	0	0	2	2	0	0	0
Y	30.0	0	0	0	0	3	1	0	0	0
Yb	3.3	0	0	0	0	2	0	0	0	0
Zr	190	0	0	0	0	0	0	0	0	0

Footnotes
refer to text for explaination of GAI (0 = not enriched->6 = highly enriched)
*Bowen H.J.M. (1979) Environmental Chemistry of the Elements and Berkman D.A. & Ryall W.R. (1976) Field Geologists Manual

Table 3 cont'd: Geochemical Abundance Indices of Ore and Waste Rock samples from the Merlin Project, Western Australia

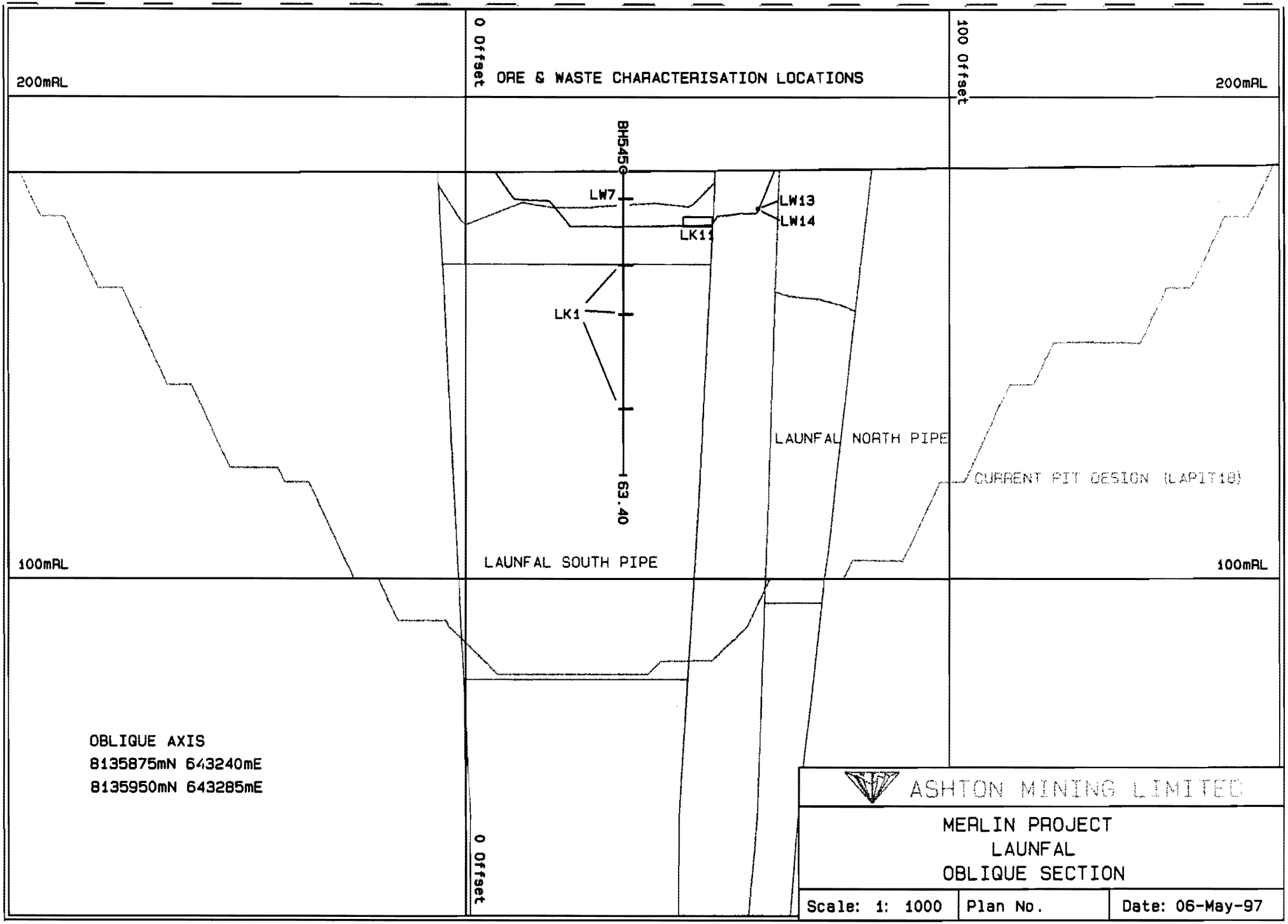
Elements	Average Crustal Abundance*	Palomides				Sacramore		
		Ore		Waste		Ore	Waste	
		PK4	PK9	PW5	PW15	SK2	SW6	SW12
Major Elements	**Environmental Indicators - Geochemical Abundance Indices#**							
Al	8.20%	0	0	0	0	0	0	0
Ca	4.10%	1	0	0	0	0	0	0
Fe	4.10%	0	1	0	0	0	0	0
K	2.10%	0	0	0	0	0	0	0
Mg	2.30%	1	0	0	0	1	0	0
Na	2.30%	0	0	0	0	0	0	0
S	0.03%	0	0	0	0	0	0	0
Minor Elements								
Ag	0.1	0	0	0	0	0	0	0
As	1.5	0	1	0	0	0	0	0
Ba	500	0	3	0	0	0	0	0
Be	2.6	0	2	0	0	2	0	0
Bi	0.17	0	0	0	0	0	0	0
Cd	0.2	0	0	0	0	1	0	0
Ce	68	1	2	0	0	1	0	0
Co	25	0	2	0	0	0	0	0
Cr	100	1	3	0	0	1	0	0
Cu	50	0	1	0	0	0	0	0
Mn	950	0	0	0	0	0	0	0
Mo	1.5	0	1	2	1	1	2	1
Ni	80	2	3	0	0	4	0	0
P	1000	0	1	0	0	0	0	0
Pb	14	0	0	0	2	1	0	0
Sb	0.2	0	1	0	0	0	1	0
Se	0.05	0	0	0	0	0	0	0
Sn	2.2	0	0	0	0	0	0	0
Sr	370	0	0	0	0	0	0	0
Tl	0.6	0	0	0	0	0	0	0
V	160	0	0	0	0	0	0	0
W	1	2	4	0	0	0	0	0
Zn	75	0	2	0	0	0	0	0
	Rare Earths and Other Metals - Geochemical Abundance Indices#							
Au	0.001	0	0	0	0	0	0	0
Os	3.0	0	0	0	0	0	0	0
Dy	6.0	0	1	0	0	0	1	0
Er	3.8	0	1	0	0	0	0	0
Eu	2.1	0	0	0	0	0	0	0
Ga	18	0	0	0	0	0	0	0
Gd	7.7	0	0	0	0	0	1	0
Ge	1.8	0	0	0	0	0	0	0
Hf	5.3	0	0	0	0	0	0	0
Ho	1.4	0	1	0	0	0	0	0
In	0.049	0	0	0	0	0	0	0
La	32	1	3	0	0	1	0	0
Li	20.0	2	0	0	0	2	0	0
Lu	0.5	0	1	0	0	0	0	0
Nb	20.0	2	4	0	0	2	0	0
Nd	38	0	1	0	0	0	0	0
Pd	0.0006	0	0	0	0	0	0	0
Pr	9.5	0	1	0	0	0	0	0
Pt	0.001	0	0	0	0	0	0	0
Rb	90	0	0	0	0	0	0	0
Re	0.0004	0	0	0	0	0	0	0
Ru	0.001	0	0	0	0	0	0	0
Sc	16	0	0	0	0	0	0	0
Sm	7.9	0	0	0	0	0	0	0
Ta	2.0	1	3	0	0	1	0	0
Tb	1.1	0	1	0	0	0	1	0
Te	0.005	0	0	0	0	0	0	0
Th	12	1	2	0	0	1	0	0
Ti	5600	0	0	0	0	0	0	0
Tm	0.5	0	1	0	0	0	0	0
U	2.4	0	1	0	0	0	0	0
Y	30.0	0	1	0	0	0	0	0
Yb	3.3	0	0	0	0	0	0	0
Zr	190	0	0	0	0	0	0	0

Footnotes
refer to text for explaination of GAI (0 = not enriched->6 = highly enriched)
*Bowen H.J.M. (1979) Environmental Chemistry of the Elements and Berkman D.A. & Ryall W.R. (1976) Field Geologists Manual

SAMPLES SENT FOR ORE/WASTE CHARACTERISATION

SAMPLE	PIPE & TYPE	LOCATION
LK1	Launfal Kimberlite	Core sample # 34 [19.90m - 20.20m] from BH545 Core sample # 36 [30.10m - 30.25m] from BH545 Core sample # 38 [49.67m - 49.85m] from BH545
SK2	Sacramore Kimberlite	Core sample # 21 [24.90m - 25.09m] from BH543 Core sample # 26 [49.90m - 50.02m] from BH543
EK3	Excalibur Kimberlite	Core sample # 48 [32.90m - 33.05m] from BH546 Core sample # 54 [47.86m - 48.02m] from BH546
PK4	Palomides Kimberlite	Core sample # 9 [21.00m - 21.20m] from BH541 Core sample # 10 [22.74m - 22.90m] from BH541
PW5	Palomides Waste	Core sample # 2 [4.70m - 5.20m] from BH541
SW6	Sacramore Waste	Core sample # 16 [6.27m - 6.40m] from BH543
LW7	Launfal Waste	Core sample # 29 [5.89m - 6.04m] from BH545
EW8	Excalibur Waste	Core sample # 44 [28.65 - 28.81m] from BH546
PK9	Palomides Kimberlite	Bulk sub sample (1996 Program) - Sample 175-1
EK10	Excalibur Kimberlite	Bulk sub sample (1996 Program) - Sample 151-2
LK11	Launfal Kimberlite	Bulk sub sample (1996 Program) - Sample 175-1
SW12	Sacramore Waste	Grab sample from pit
LW13	Launfal Waste	Grab sample from pit
LW14	Launfal Waste	Grab sample from pit
PW15	Palomides Waste	Gab sample from pit
EW16	Excalibur Waste	Core sample from BH113 ~9m

F:\DOCS\F-NOTE\067-MERL



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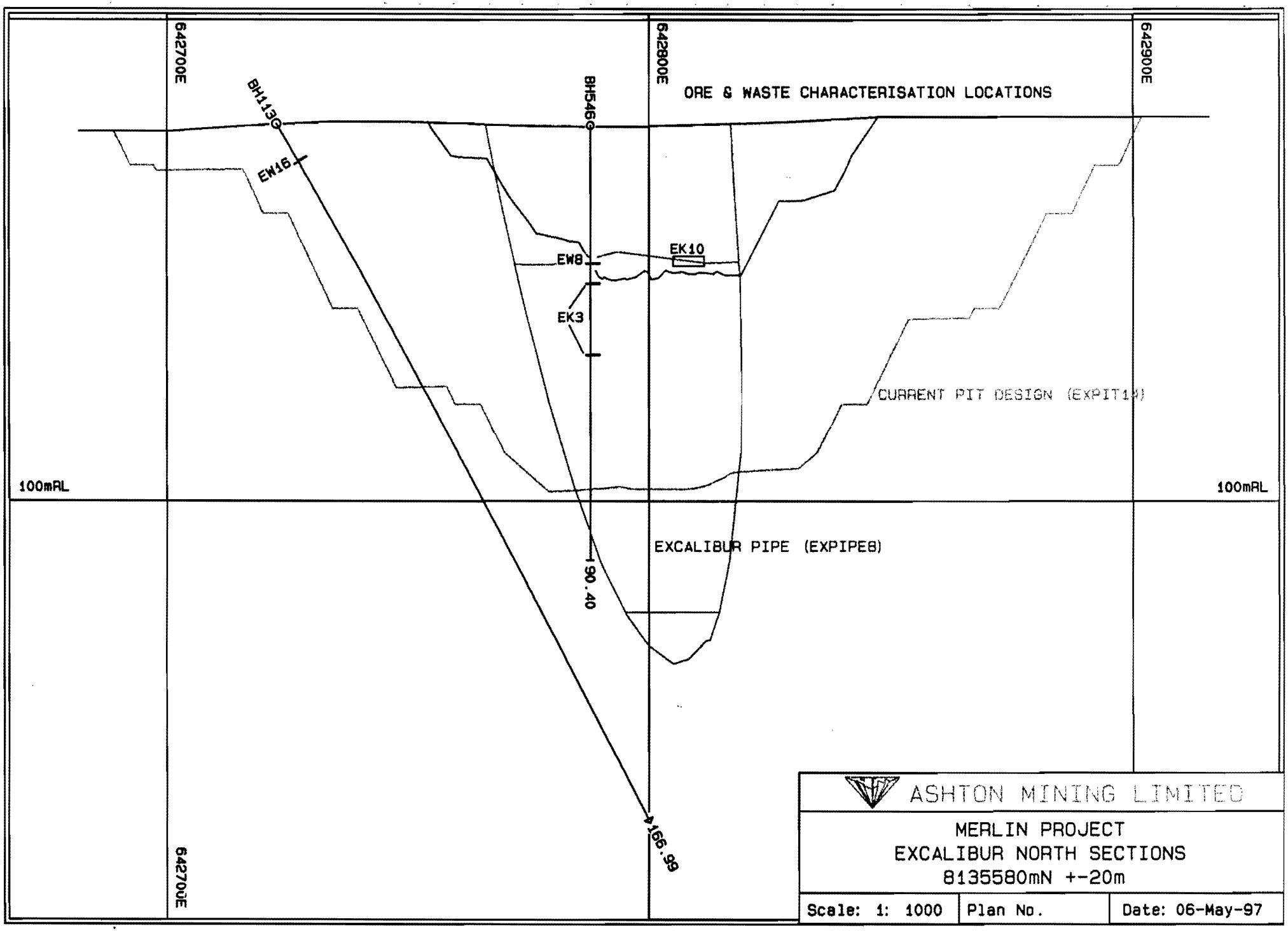
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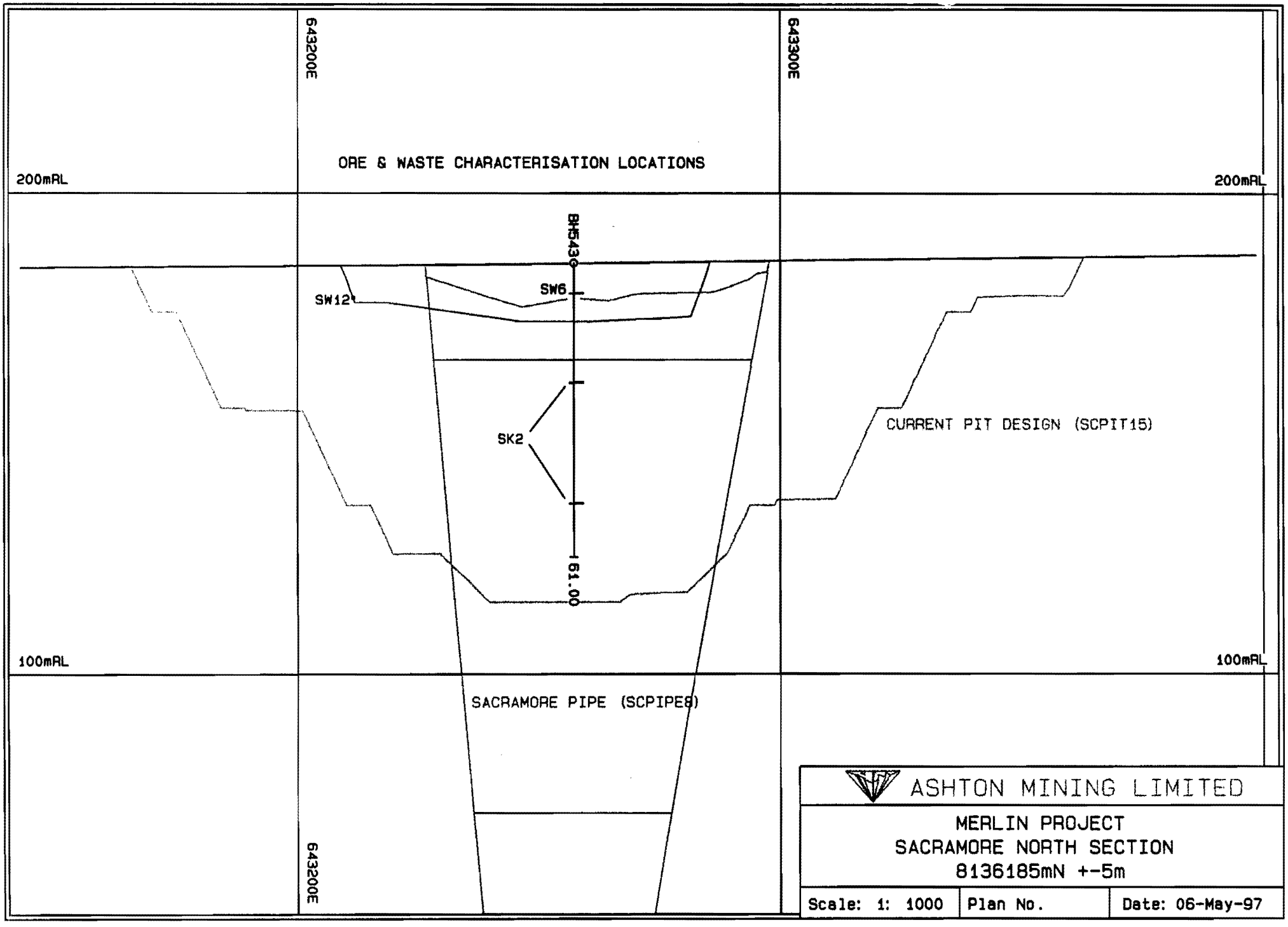
642800E
642900E
ORE & WASTE CHARACTERISATION LOCATIONS
BH1130
BH5460
EW16
EW8
EK10
EK3
CURRENT PIT DESIGN (EXPIT1H)
100mRL
100mRL
EXCALIBUR PIPE (EXPIPE8)
90.40
166.99
642700E
ASHTON MINING LIMITED
MERLIN PROJECT
EXCALIBUR NORTH SECTIONS
8135580mN +-20m
Scale: 1: 1000
Plan No.
Date: 06-May-97
EXOWA4.LF
SURPAC SOFTWARE INTERNATIONAL. AUSTRALIA



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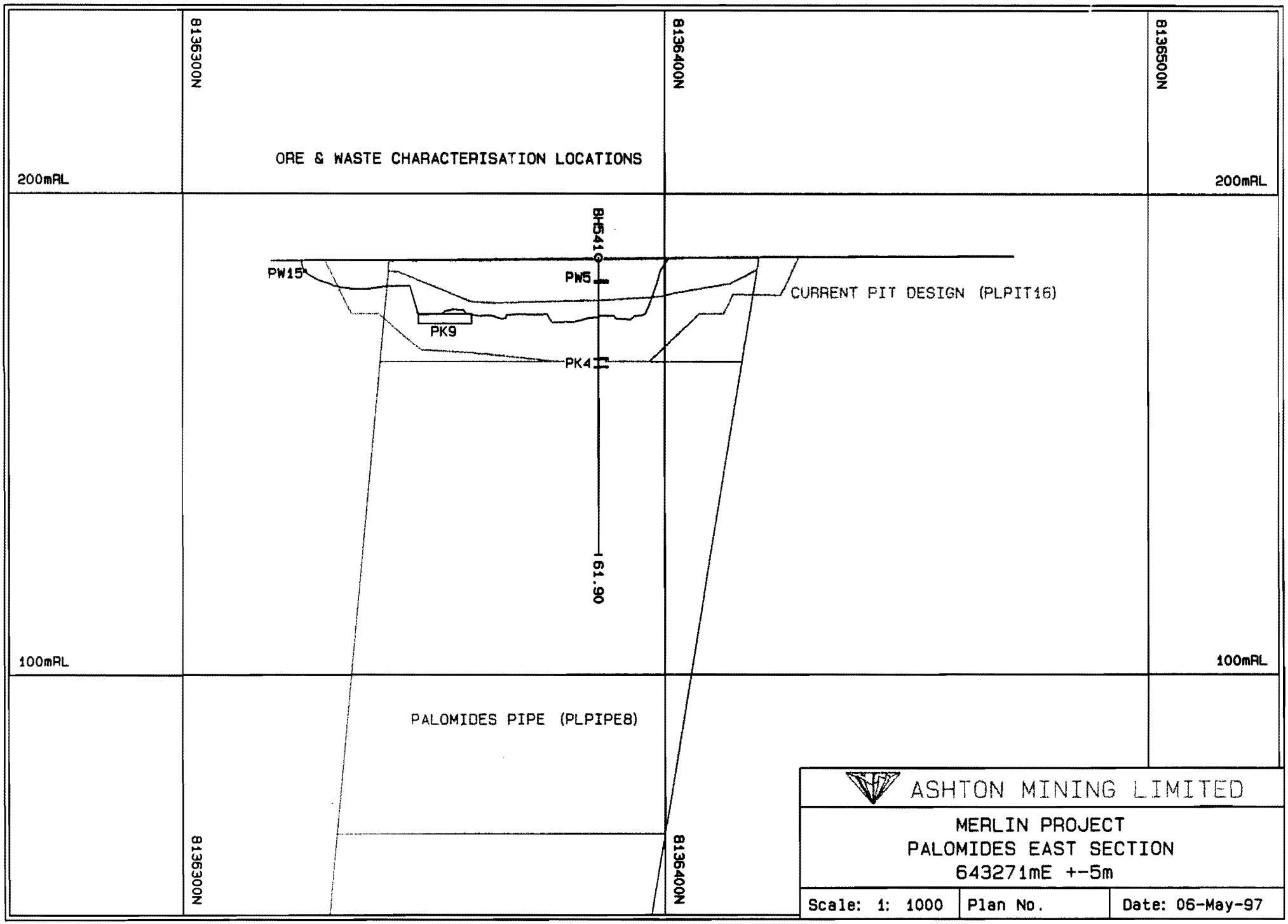

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SURPAC SOFTWARE INTERNATIONAL. AUSTRALIA

Genalysis Laboratory Services Pty. Ltd.

ANALYSTS AND CONSULTING CHEMISTS
ACN: 008 787 237

ATTENTION C MARISSEN
ASHTON MINING LIMITED
21 WYNYARD STREET
BELMONT WA 6104
AUSTRALIA

Analytical Report

COMMENTS
ATTENTION: C MARISSEN ..
ROCK....

JOB INFORMATION

JOB CODE	:207.1/970973
No. SAMPLES	:16
ELEMENTS	:71
CLIENT O/N	:9713
DATE RECEIVED	:17/02/97
DATE COMPLETED	:07/03/97

LEGEND

'X'	= LESS THAN DETECTION LIMIT
'N/R'	= SAMPLE NOT RECEIVED
'*'	= RESULT CHECKED
'( )'	= RESULT STILL TO COME
'I/S'	= INSUFFICIENT SAMPLE FOR ANALYSIS
'E6'	= RESULT x 1,000,000

MAIN OFFICE AND LABORATORY
17 DAVISON ST, MADDINGTON, WA 6109
P.O. BOX 144 GOSNELLS WA 6110
Tel:(09)459 9011 Fax:(09)459 5343

KALGOORLIE SAMPLE PREPARATION DIVISION
12 KEOGH WAY, KALGOORLIE WA 6430
P.O. BOX 388 KALGOORLIE WA 6430
Tel:(090)21 2881 Fax:(090)21 3476

SAMPLE DETAILS

SAMPLE STATE(S) & SAMPLE PREPARATION(S)

Rock Chip Sample(s)
Crush
Mix & Split,Single Stage Mix & Grind (chrome-steel bowl), Quartz Wash

SAMPLE STORAGE DETAILS

GENERAL CONDITIONS :
SAMPLE STORAGE OF SOLIDS
Bulk Residues and Pulps will be stored for 60 days without charge. After this time all Bulk Residues and Pulps will be stored at a rate of $1.20/cubic metre/day until your written advice regarding collection or disposal is received. Expenses related to the return or disposal of samples will be charged to you at cost.

SAMPLE STORAGE OF SOLUTIONS
Samples received as liquids ,waters or solutions will be held for 6 weeks free of charge then disposed of , unless written advice for return or collection is received.

NOTES

Please Note in the followong report...

The Acid Neutralising Capacity (ANC:/VOL) is expressed as percent CaCO3.

The Nett Acid Generation (NAG:/VOL) is expressed as kg of H2SO4 per tonne of sample. The pH and EC of this extract is reported as NAGpH & NAGeC.

The Nett Acid Producing Potential (NAPP) reported below is calculated and expressed as kg of H2SO4 per tonne of sample.

Sample Number	NAPP
EK03	-262.5
EK10	-14.5
EW08	-0.85
EW16	-0.35
LK01	-5.75
LK11	-3.25
LW7	-0.85
LW13	0.15
LW14	0.15
PK04	-515
PK09	-11.4
PW05	-2.35
PW15	0.15
SK02	-220
SW06	-2.35
SW12	-0.35

ANALYSIS

ELEMENTS	Au	Li	Be	Na	Mg	Al	P	S	K	Ca	Sc
UNITS	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
DETECTION	0.5	0.5	0.1	20	20	20	20	10	20	10	2
METHOD	A/MS	A/MS	A/MS	A/OES	A/OES	A/OES	A/OES	A/OES	A/OES	A/OES	A/OES
SAMPLE NUMBERS											
1 EK03	0.5	50.0	2.0	720	5.80%	2.65%	5200	620	1.80%	8.80%	14
2 EK10	0.5	10.5	7.2	440	1.50%	3.60%	1.35%	60	8800	2.55%	18
3 EW08	X	7.0	1.8	260	1180	1.08%	1080	30	5000	720	2
4 EW16	X	1.5	0.4	940	540	2.80%	120	20	2.90%	140	2
5 LK01	X	12.5	6.0	660	8800	5.00%	3800	40	2.50%	1200	22
6 LK11	0.5	6.5	16.0	1300	8000	6.40%	4900	70	2000	360	28
7 LW07	X	5.0	0.8	260	1450	1.95%	360	30	2150	230	4
8 LW13	X	2.5	0.3	400	340	1.70%	320	30	1.06%	110	2
9 LW14	X	2.5	0.3	420	340	1.40%	220	20	1.00%	120	2
10 PK04	X	88.0	0.8	840	7.20%	1.35%	1080	X	3500	16.00%*	6
11 PK09	0.5	15.5	11.4	1750	1.45%	6.60%	3000	700	1400	5600	26
12 PW05	X	5.0	0.9	820	2150	1.40%	520	50	2300	660	2
13 PW15	X	4.5	0.2	200	140	1.35%	200	20	3700	100	X
14 SK02	X	118.0	12.5	820	9.20%	1.80%	1300	200	8200	3.70%	8
15 SW06	X	6.5	2.4	900	2550	1.70%	1060	50	2300	480	4
16 SW12	X	5.5	0.4	160	460	1.25%	640	100	3600	230	2
Ch.0001(EK03)	0.5	50.0	2.0	720	6.00%	2.60%	5200	620	1.85%	8.80%	12
STD: SY3				2.90%	1.50%	6.00%	2350	520	3.50%	5.80%	12
STD: SY3		90.0	23.5								
STD: LECO5											
STD: PD-1											

ANALYSIS

ELEMENTS	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge
UNITS	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm
DETECTION	5	2	2	1	0.01	1	1	1	1	1	0.5
METHOD	A/OES	A/OES	A/OES	A/OES	A/OES	A/MS	A/OES	A/OES	A/OES	A/MS	A/MS
SAMPLE NUMBERS											
1 EK03	3400	68	740	860	4.30	82	1100	78	84	7	1.5
2 EK10	4100	92	860	5000	* 15.50	175	1550	125	1000	* 11	2.5
3 EW08	500	18	112	47	0.96	10	29	6	37	3	1.0
4 EW16	390	8	82	35	0.98	2	11	5	22	5	1.5
5 LK01	6600	225	490	1900	6.40	56	960	64	340	15	1.5
6 LK11	5800	175	1600	1500	15.00	74	980	130	560	14	1.5
7 LW07	640	24	100	21	1.04	1	18	5	18	4	1.5
8 LW13	360	12	110	17	0.43	1	8	5	8	3	1.0
9 LW14	420	10	116	24	0.40	1	7	6	10	3	1.0
10 PK04	1500	28	255	780	2.55	31	430	22	34	4	1.0
11 PK09	5800	130	1160	2000	13.50	125	1200	135	520	14	1.5
12 PW05	660	28	160	96	1.65	3	29	7	31	3	1.0
13 PW15	285	4	120	35	0.34	1	5	4	5	2	1.0
14 SK02	1700	38	265	660	3.20	38	1900	31	520	5	1.0
15 SW06	1000	54	130	50	2.20	2	22	37	48	5	1.0
16 SW12	265	10	135	37	0.40	1	8	4	10	2	1.0
Ch.0001(EK03)	3600	66	740	880	4.50	86	1080	78	86	8	1.5
STD: SY3	900	54	6	2350	4.40		9	20	240		
STD: SY3						9				29	1.0
STD: LECO5											
STD: PD-1											

ANALYSIS

ELEMENTS	As	Se	Rb	Sr	Y	Zr	Nb	Mo	Ru	Pd	Ag
UNITS	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
DETECTION	2	10	0.2	0.1	0.1	1	0.5	0.5	0.5	1	0.5
METHOD	A/MS	A/MS	A/MS	A/MS	A/MS	A/MS	A/MS	A/MS	A/MS	A/MS	A/MS
SAMPLE NUMBERS											
1 EK03	2	x	200.0	280.0	16.5	98	420.0	2.5	x	x	x
2 EK10	8	x	84.0	275.0	27.0	150	470.0	2.5	x	x	x
3 EW08	2	x	25.5	120.0	17.0	31	2.5	2.0	x	x	x
4 EW16	2	x	112.0	49.0	3.1	108	2.5	2.0	x	x	x
5 LK01	4	x	76.0	350.0	280.0	104	170.0	5.0	x	x	0.5
6 LK11	2	x	18.0	720.0	80.0	145	580.0	1.0	x	x	x
7 LW07	x	x	13.5	68.0	6.8	45	3.5	2.0	x	x	x
8 LW13	x	x	42.0	110.0	11.0	64	2.5	2.0	x	x	x
9 LW14	x	x	40.0	60.0	10.8	84	2.5	3.0	x	x	x
10 PK04	x	x	41.0	490.0	7.6	46	125.0	1.0	x	x	x
11 PK09	4	x	17.5	480.0	104.0	145	480.0	5.0	x	x	x
12 PW05	x	x	13.5	130.0	39.0	32	9.5	7.0	x	x	x
13 PW15	x	x	16.5	26.0	11.4	40	2.0	4.5	x	x	x
14 SK02	2	x	70.0	180.0	11.6	70	125.0	3.5	x	x	x
15 SW06	x	x	14.0	185.0	58.0	56	3.0	8.0	x	x	x
16 SW12	x	x	15.0	285.0	30.0	41	1.5	5.5	x	x	x
Ch.0001(EK03)	2	x	205.0	285.0	17.0	100	440.0	3.0	x	x	x
STD: SY3											
STD: SY3	18	x	210.0	310.0	680.0	320	210.0	1.0			x
STD: LECO5											
STD: PD-1											

ANALYSIS

ELEMENTS	Cd	In	Sn	Sb	Te	Cs	Ba	La	Ce	Pr	Nd
UNITS	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
DETECTION	0.5	0.1	1	0.2	0.5	0.2	1	0.1	0.1	0.1	0.1
METHOD	A/MS	A/MS	A/MS	A/MS	A/MS	A/MS	A/MS	A/MS	A/MS	A/MS	A/MS
SAMPLE NUMBERS											
1 EK03	X	X	1	0.4	X	4.0	2050	340.0	460.0	38.0	104.0
2 EK10	1.0	X	2	0.8	X	5.2	2550	390.0	540.0	45.0	125.0
3 EW08	X	X	1	0.2	X	1.2	370	19.5	43.0	4.8	18.5
4 EW16	X	X	1	0.4	X	2.4	490	11.4	19.5	1.9	5.4
5 LK01	X	0.1	2	1.8	0.5	4.0	5200	160.0	250.0	25.0	84.0
6 LK11	X	0.1	2	1.2	X	3.0	6400	620.0	780.0	64.0	180.0
7 LW07	X	X	1	0.2	X	1.0	245	32.0	72.0	8.4	32.0
8 LW13	X	X	1	0.4	X	1.4	450	10.8	23.5	2.5	9.4
9 LW14	X	X	1	0.4	X	1.4	370	11.4	25.0	2.7	9.4
10 PK04	X	X	1	0.4	X	2.0	980	114.0	155.0	13.0	37.0
11 PK09	X	0.1	2	0.8	X	4.6	5200	350.0	470.0	39.0	110.0
12 PW05	X	X	1	0.2	X	0.8	580	24.5	54.0	6.8	35.0
13 PW15	X	X	X	0.2	X	0.4	295	9.6	18.5	1.8	6.4
14 SK02	0.5	X	1	0.4	X	2.6	540	110.0	155.0	13.5	38.0
15 SW06	X	X	1	0.6	X	1.0	740	20.0	46.0	6.0	34.0
16 SW12	X	X	1	0.2	X	0.6	760	21.5	50.0	5.6	22.5
Ch.0001(EK03)	X	X	1	0.4	X	4.0	2100	340.0	460.0	39.0	106.0
STD: SY3											
STD: SY3	X		6	0.4	0.5	3.0	420	1250.0	2150.0	225.0	720.0
STD: LECO5											
STD: PD-1											

ANALYSIS

ELEMENTS	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf
UNITS	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
DETECTION	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.5
METHOD	A/MS	A/MS	A/MS	A/MS	A/MS	A/MS	A/MS	A/MS	A/MS	A/MS	A/MS
SAMPLE NUMBERS											
1 EK03	11.0	2.5	7.8	0.9	4.0	0.6	1.8	0.2	1.1	0.2	3.0
2 EK10	14.0	3.1	10.0	1.2	5.6	0.9	2.7	0.3	1.9	0.3	4.0
3 EW08	3.7	0.7	3.7	0.5	3.0	0.5	1.4	0.2	1.1	0.2	1.0
4 EW16	0.7	0.1	0.6	0.1	0.6	0.1	0.4	0.1	0.7	0.1	3.5
5 LK01	14.5	3.7	15.5	3.5	33.0	8.0	26.0	4.0	25.0	3.9	3.0
6 LK11	20.5	4.8	15.0	2.4	14.0	2.5	6.4	0.8	4.3	0.7	4.0
7 LW07	5.8	1.3	5.2	0.6	2.2	0.3	0.7	0.1	0.7	0.1	1.5
8 LW13	2.1	0.5	2.9	0.4	2.5	0.4	1.1	0.2	1.0	0.2	2.0
9 LW14	1.7	0.4	2.0	0.3	3.2	0.4	1.2	0.2	1.2	0.2	2.5
10 PK04	4.3	0.9	3.0	0.4	1.7	0.3	0.9	0.1	0.7	0.2	1.5
11 PK09	15.0	3.6	13.0	2.4	16.5	3.2	9.2	1.2	6.6	1.2	4.0
12 PW05	14.5	4.0	14.5	1.5	8.0	1.4	3.9	0.5	3.2	0.5	1.0
13 PW15	1.3	0.2	1.6	0.3	2.0	0.4	1.2	0.2	1.1	0.2	1.5
14 SK02	4.7	1.1	3.8	0.5	2.5	0.4	1.3	0.2	1.1	0.2	2.0
15 SW06	14.0	3.8	19.0	2.6	13.5	2.3	6.0	0.8	5.0	0.8	1.5
16 SW12	5.0	0.9	5.6	0.8	5.4	1.1	2.9	0.4	2.4	0.4	1.5
Ch.0001(EK03)	11.2	2.6	7.8	0.9	4.1	0.6	1.8	0.2	1.4	0.3	3.0
STD: SY3											
STD: SY3	120.0	19.0	118.0	17.0	135.0	29.5	80.0	11.2	68.0	8.4	9.5
STD: LECO5											
STD: PD-1											

ANALYSIS

ELEMENTS	Ta	W	Re	Pt	Tl	Pb	Bi	Th	U	ANC	S-Tot
UNITS	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	%
DETECTION	0.2	1	0.2	0.5	0.2	2	0.5	0.1	0.1	0.05	0.005
METHOD	A/MS	A/MS	A/MS	A/MS	A/MS	A/MS	A/MS	A/MS	A/MS	/VOL	/LECO
SAMPLE NUMBERS											
1 EK03	15.5	2	x	x	0.2	84	0.5	88.0	5.4	27.00	0.045
2 EK10	20.0	4	x	0.5	0.8	100	x	96.0	6.8	1.50	x
3 EW08	0.2	1	x	0.5	x	4	x	4.3	1.9	0.10	x
4 EW16	0.2	2	x	0.5	0.6	12	x	4.4	1.1	0.05	x
5 LK01	8.6	5	x	0.5	0.4	22	0.5	39.0	11.4	0.60	x
6 LK11	28.0	8	x	0.5	0.2	94	x	114.0	13.5	0.35	x
7 LW07	0.2	1	x	0.5	x	6	x	5.6	0.7	0.10	x
8 LW13	0.2	2	x	0.5	0.2	12	x	5.4	1.3	x	x
9 LW14	0.2	1	x	0.5	0.2	16	x	6.0	1.5	x	x
10 PK04	5.4	6	x	0.5	x	18	x	27.0	1.8	52.50	x
11 PK09	24.0	19	* x	0.5	0.2	14	x	96.0	7.6	1.40	0.070
12 PW05	0.6	2	x	0.5	x	6	x	5.4	1.2	0.25	x
13 PW15	0.2	2	x	0.5	x	68	x	4.2	1.3	x	x
14 SK02	6.2	6	x	0.5	0.2	34	x	28.0	3.2	22.50	x
15 SW06	0.2	1	x	0.5	x	6	x	4.7	3.8	0.25	x
16 SW12	0.2	2	x	0.5	x	10	x	4.2	1.6	0.05	x
Ch.0001(EK03)	18.0	3	x	0.5	0.2	84	x	88.0	5.4	25.50	0.040
STD: SY3											
STD: SY3	28.0	2			1.2	145	0.5	1000.0	660.0		
STD: LECO5											1.850
STD: PD-1											

ANALYSIS

ELEMENTS	S-SO4	NAG	NAGpH	NAGeC	S-S2-
UNITS	%			mS/cm	%
DETECTION	0.01	2	0.1	0.01	0.01
METHOD	X/OES	/VOL	/METR	/METR	/CALC
SAMPLE NUMBERS					
1 EK03	0.04	X	9.1	0.12	X
2 EK10	0.02	X	8.6	0.05	X
3 EW08	X	2	5.7	0.02	X
4 EW16	X	X	5.2	0.02	X
5 LK01	X	X	6.9	0.04	X
6 LK11	X	X	5.8	0.03	X
7 LW07	X	X	5.0	0.02	X
8 LW13	X	X	5.1	0.02	X
9 LW14	X	X	5.4	0.10	X
10 PK04	X	X	8.6	0.18	X
11 PK09	0.06	X	8.8	0.08	0.01
12 PW05	X	2	5.2	0.03	X
13 PW15	X	X	4.9	0.02	X
14 SK02	0.01	X	8.8	0.10	X
15 SW06	X	X	5.7	0.03	X
16 SW12	X	X	5.5	0.02	X
Ch.0001(EK03)	0.03	X	9.1	0.10	0.01
STD: SY3					
STD: SY3					
STD: LECO5					
STD: PD-1	4.60				

METHOD CODE DESCRIPTIONS

A/MS
Multi-acid digest including Hydrofluoric, Nitric, Perchloric and Hydrochloric acids.
Analysed by Inductively Coupled Plasma Mass Spectrometry.

A/OES
Multi-acid digest including Hydrofluoric, Nitric, Perchloric and Hydrochloric acids.
Analysed by Inductively Coupled Plasma Optical (Atomic) Emission Spectrometry.

/VOL
Analysed by Volumetric Technique.

/LECO
LECO Analyser.

X/OES
Client Specified Digestion or Extraction.
Analysed by Inductively Coupled Plasma Optical (Atomic) Emission Spectrometry.

/METR
Analysed using an Electronic Meter (eg pH or conductivity meter).

/CALC
Results Determined by calculation from other reported data.

APPENDIX C

Ashton Mining Ltd,
Merlin Project

Proposed Access Road

Report on

Report on Design Requirements

June 1997

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Document Status

Rev No.	Author	Reviewer	Approved for Issue		
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Proposed Access Road Report on Design Requirements

1. INTRODUCTION

Gutteridge Haskins and Davey Pty Ltd was commissioned by Ashton Mining Ltd to investigate, design, and document the access road as part of the Merlin Project. The access road extends from the Merlin Project site at Boomerang Creek, to the Carpentaria Highway, intersecting it approximately 5km to the west of the McArthur River Mine.

The access road broadly follows the alignment of the existing access track, and contains two major river crossings, at the McArthur River, and the Glyde River.

The aim of this report is to set down the basis for design of the access road, and provide discussion of the alternatives chosen for the various aspects of the work. The contents of the report are understood to be included in the Public Environmental Report for the project.

2. BACKGROUND

Ashton Mining Ltd are undertaking a feasibility study into the establishment and operation of a diamond mine at Boomerang Creek, south-east of McArthur River, in the NT.

An integral component of the mine infrastructure is the access road, which is currently 70km long, and of a poor standard. In order for operations to be effectively maintained, the access road needs to be upgraded to facilitate regular movement of heavy vehicles, in order for supplies to be moved. Because of the large investment represented by the road upgrade, this aspect has a significant impact on the project.

The existing access road had received minor repairs and upgrade during the project investigation stage. It had also been flown to produce stereo aerial photographs, and had been surveyed (including a significant corridor either side) for Aboriginal sites.

3. DESCRIPTION OF THE WORKS

3.1 General

The existing access track is currently approximately 70 km long, from the existing Merlin Project camp to the junction with the Carpentaria Highway. The proposed new access road will be approximately 62km in length, following the existing track alignment in most areas. The route crosses the McArthur River approximately 2.2km from the Carpentaria Highway intersection, and the Glyde River some 45km further towards the mine site. In between there are numerous minor watercourse crossings, including Amelia and Lamont Creeks.

The alignment is controlled by several factors:

- Glyde River

  The Glyde River, along a substantial portion of its length adjacent to the access road, forms a rocky and impenetrable ravine, which could only be crossed using a substantial bridge structure. Construction, financial, and environmental problems associated with a crossing of this nature were considered prohibitive, and in effect, the Glyde formed a bound to the easterly development of the road, prior to the crossing available near Bullock Creek.

- Rocky Terrain

  Whilst there is enough relief in the terrain to theoretically align the road to ridges and high ground, the steepness and rockyness of the ridges precluded this approach on the basis of constructability and cost. The road alignment selected has needed to balance the need to elevate the road as much as possible, whilst avoiding the sharp ridges and escarpments that occur throughout the locality.

- Aboriginal Sacred Sites.

  The entire route for the existing access track had already been surveyed by the AAPA, with the AAPA certificate identifying sacred areas. A number of these formed controls to the selection of alignment, the most obvious of which is the hills either side of Lamont Pass. In addition, the presence of the existing cleared corridor provided incentive to maintain an alignment within that cleared corridor, so as to avoid the requirement for further clearances.

3.2 River and Creek Crossings

As noted above, the proposed access road crosses two rivers, several creeks, and numerous drainage channels.

The design methodology for stream crossings has been to provide a level of service commensurate with the design life of the Stage One plant (understood to be in the order of 2 ½ years). To provide uninhibited access at all times would be prohibitive, and so an approach was adopted that accepted:

- that closures at major watercourses of up to 5 days at a time would be acceptable,
- that a reasonable amount of maintenance and repair work would be acceptable, following the wet seasons.

The river crossings have been designed as culverts which will maintain trafficability during low flow events, and maintain stability during major river flows. The road surfaces will be stabilised, and the embankments and approaches afforded some protection, in order to limit deterioration during large flow events.

Alternative crossing designs have been designed and documented, as options to be considered should the cost of the original river crossing designs be prohibitively expensive.

The creeks and other minor drainage channels are designed as bed level crossings, except for where the natural terrain would require substantial earthworks to maintain trafficability. In these instances, pipe culverts have been designed. Bed level crossings are generally cement stabilised, except where the natural terrain is rocky and not prone to deterioration during wet weather.

3.3 Carpentaria Highway Intersection

The intersection of the proposed access road and the Carpentaria Highway is located some 69km south-west of Borroloola Homestead (approximately 5km south-west of McArthur River Mine). This will be the main transport access to the mine site, but will be subject to very low traffic volumes due to the closed (secure) nature of the mine.

There is currently no existing intersection at the site, as the existing access track joins the Carpentaria Highway further to the south.

4. HYDROLOGY AND HYDRAULIC ANALYSIS

4.1 Methodology

Historic flow records were available for both the McArthur and Glyde Rivers, from stream guages maintained by NT Water Resources Branch of Department of Lands, Planning and Environment. These were analysed to give an indication of the design flows to be used at each crossing. The initial target design criteria was that the crossings were not to be rendered impassable for more than 5 consecutive days, on an average of once every five years (ARI5).

The data was examined to determine the maximum flow rate for five consecutive days for each rainfall event. From these flow rates, a frequency analysis was undertaken to provide an estimate of the flows corresponding to Average Recurrence Intervals (ARI) of 2 to 5 years.

The design of the river crossings was undertaken using the HECRAS modelling program.

Minor drainage paths that were assessed as requiring culverts, were designed to prevent overtopping of the road in the 20 year ARI event. In this way, for the small cost of larger pipe sizes, expensive protection works were avoided.

4.2 Results

4.2.1 McArthur River

Some 22 years of daily flow records between 1973 and 1995 were available at a flow gauging station located approximately 7 km from the proposed access road crossing. However much of this data was unreliable as there were very frequent missing records throughout the data, most of which occurred during the wet season. Four years of data between 1980 and 1984 had to be excluded from the analysis because of the large number of missing records throughout this period. The remaining 2 periods were analysed by ignoring the missing records, and hence the results of the analysis should be viewed as being indicative only rather than dependable or exact.

A frequency analysis was undertaken for each period and the results were averaged to yield the following:

A.R.I	Flow (m^3/s)
2	300
3	500
4	700
5	850

According to the HECRAS model of the crossing location, a flow of $850m^3/s$ corresponds to a flow depth of approx. 5m. To provide for this depth of flow, a bridge would be required. Budgetary constraints do not allow for a bridge crossing, and a culvert option consisting of 17/3000 x 3000 RCBC + Link Slabs was assessed as being a reasonable compromise, and represents an ARI of approximately 3-4 years under the design criteria.. Allowing for 300mm depth of pavement to be constructed directly above the link slabs, the corresponding top of road level would be 35.67m RL. For this arrangement, the following results are obtained:

Flow (m^3/s)	Upstream Water Level (m RL)	Depth Above Road (m)	Velocity Above Road (m/s)	Velocity Through Culvert (m/s)
500	35.90	0.23	1.4	2.8
700	36.63	0.96	2.2	2.2

For this configuration significant scour protection would be required on the downstream side of the culvert. An alternative culvert option based on the 2 year ARI design event was also designed.

4.2.2 Glyde River

Approximately 12.5 years of flow records were available from a flow gauging station located approx. 20km downstream of the proposed crossing location. The extra catchment area contributing to the gauging station is significant, resulting in the design flows obtained from the analysis being conservative. As with the McArthur River records, there were frequent periods of missing data in the flow records, however many of these were in the dry season. The results from the analysis are therefore reasonably dependable, but they should still be considered approximate due to the relatively limited duration of the flow records.

The results of the frequency analysis are as follows:

A.R.I	Flow (m^3/s)
2	100
3	160
4	250
5	300

According to the HECRAS model of the crossing location, a flow of $300m^3/s$ corresponds to a flow depth of approx. 3.75 m. While using 2.7m or 3.0m high culverts would allow the crossing to be used during the 5 year ARI event, it is questionable whether the extra expense of the higher culverts would be warranted if the budget is tight, considering the McArthur River crossing would only be passable during the 3 to 4 year ARI events with the recommended culvert option.

A culvert crossing consisting of 13/3000 x 1800 RCBC + Link Slabs is recommended. Allowing for 300mm depth of pavement to be constructed directly above the link slabs, the corresponding top of road level would be 76.08m RL. For this arrangement, the following results are obtained:

Flow (m^3/s)	Upstream Water Level (m RL)	Depth Above Road (m)	Velocity Above Road (m/s)	Velocity Through Culvert (m/s)
100	75.72	-	-	1.3
160	76.46	0.38	1.8	1.3
250	76.94	0.86	2.0	1.0
300.	77.15	1.07	2.2	0.9

An alternative culvert option based on the 2 year ARI design event was also designed.

4.2.3 Minor Drainage Structures

Minor drainage structures were designed on the basis of the limited catchment information available from existing mapping and aerial photography. Without being considered definitive, or precise, the catchment assessments are the best possible under the scope of the commission.

The following culvert sizes were selected:

Chainage	Culvert Size
1951	3/2100mm diam
31245	1/1500mm diam
34814	2/1500mm diam
43650	2/1200mm diam
43956	2/1500mm diam
44286	1/2100mm diam
44739	2/1500mm diam
45038	1/1500mm diam

5. DESIGN CONSIDERATIONS

5.1 Pavement Design

The design of the access road pavement involved assessment of the frequency and nature of traffic, the insitu and available gravel materials and a value assessment of design options given the possible life of the road.

A single pavement design was adopted. The subgrade has been assessed as being relatively sound along the entire length of the road, as confirmed by reports that traffic currently passes at most times of the year. Nevertheless, this will be reviewed as construction proceeds on site. The base course gravels available have reasonable strengths for an unsealed gravel road.

The traffic anticipated will only extend to:

- a single semi-trailer per week, and
- a single passenger vehicle per day.

Given that the Stage One plant is to be run for only 2 ½ years, and that the road may have a life limited to that, this equates to a very low traffic volume.

A uniform 150 thick gravel pavement, cement stabilised in water courses, has been adapted throughout.

5.2 Earthworks

Earthworks for the access road will consist mainly of clearing and cut/fill operations. Clearing is required to remove trees, debris and topsoil, but will only be required where the existing alignment is not being followed. Generally, the road will be required to be raised above the existing natural surface, with table drains and offlets cut. Some sections of the alignment will be constructed to a grade line which will require cut to fill earth movements.

Pavement material will be naturally occurring gravels extracted from gravel pits along the route. A gravel search has been carried out over a portion of the route to identify possible gravel sources.

It is possible that mine waste material could be used, provided it meets the required engineering specifications.

5.3 River Crossings

As discussed earlier, only moderate velocities are expected within the streams at the river crossings. Nevertheless, a moderate amount of protection works is appropriate for stability of the culvert structures, and to minimise the recurrent maintenance requirements.

Depending on availability of protection materials, the extent of batter and culvert protection will be reassessed on site. However, protection works as a minimum will be as per the appended documentation. This will include:

- rubble protection to the stream bed upstream of the culvert,
- reno mattress protection to the stream bed down-stream of the culvert,
- stabilisation of the pavement,
- grouted stone pitching to batters steeper than one in four (V.H) slope.

Additional protection in the form of rubble may be added as the need arises.

5.4 Minor Stream Crossings

Where the stream has a rocky base which is unlikely to deteriorate under wheeled traffic in wet weather, no treatment is proposed. Elsewhere, however, that part of the pavement likely to be saturated by stormwater is to be cement stabilised to prevent erosion and rutting.

Where culverts are provided, grouted stone pitching is to be constructed to protect the pipe surround from the danger of piping failures along the pipes.

5.5 Intersection Design

The intersection of the Carpentaria Highway with the access road will be subject to very little traffic, however it has been designed to minimise long term maintenance requirements. In particular, the requirements of the NT Department of Transport and Works (DTW), have been relied upon for direction.

It should be noted that the plan appended (19212-C49) is subject to imminent revision to reflect some key DTW requirements. In particular, these include:

- bitumising the entire intersection within the road reserve,
- concreting the drainage invert in lieu of cement stabilisation,

as well as other minor changes.

Appropriate traffic control measures will be required during construction, and will comply with AS1742.

6. REFERENCES

1. A R & R (Australian Rainfall & Runoff) - A Guide to Flood Estimation, 1987, Vol 1.
2. US Army Corps of Engineers, "HEC-RAS River Analysis System User Manual and Hydraulic Reference Manual", July 1995.
3. NT Water Resources Branch of Department of Lands, Planning and Environment - Gauged River Flow Data.
4. Austroads, " Intersections at Grade", 1988
5. Guidelines for Road Design, DTW.
6. Dames and Moore, "Report on Gravel Search, Access Road from 8 Mile Waterhole towards Merlin Project Site, NT", Nov. 1996.

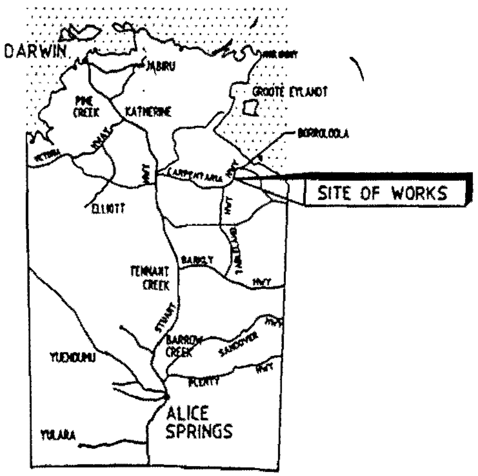
7. GHD "Merlin Prospect (Boomerang Creek) Access Road, Detailed Preliminary Estimate", September 1996.

8. GHD "Merlin Prospect (Boomerang Creek) Access Road, Assessment of Alternative Route", October 1996.

Appendix 1

Typical Drawings

DO NOT SCALE



LOCALITY PLAN

GENERAL LEGEND

DESIGN CENTRELINE

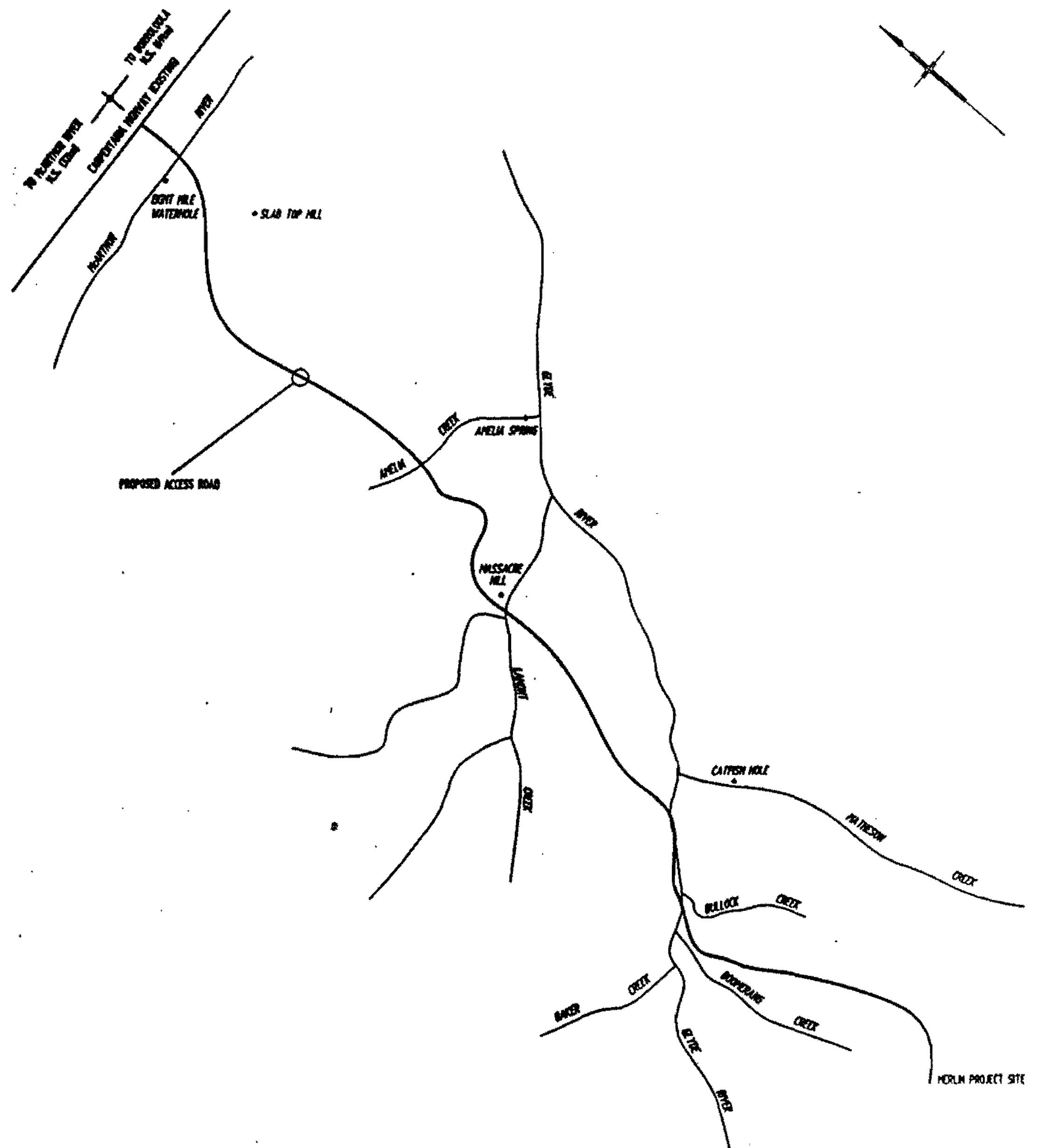
EXISTING CENTRELINE

DRAINAGE LINE (CREEK, RIVER, GULLY, ETC) AND DIRECTION OF FLOW

SCHEDULE OF DRAWINGS

PROJECT DRAWINGS	
DRG. NO.	DESCRIPTION
19212-C00	LOCALITY PLAN, SITE PLAN & SCHEDULE OF DRAWINGS
19212-C01	TYPE CROSS SECTIONS AND DETAILS
19212-C02	COMPILATION PLAN & SURVEY DATA
19212-C03	PLAN & LONGITUDINAL SECTION CH 00-1500
19212-C04	PLAN & LONGITUDINAL SECTION CH 1500-3000
19212-C05	PLAN & LONGITUDINAL SECTION CH 3000-4500
19212-C06	PLAN & LONGITUDINAL SECTION CH 4500-6000
19212-C07	PLAN & LONGITUDINAL SECTION CH 6000-7500
19212-C08	PLAN & LONGITUDINAL SECTION CH 7500-9000
19212-C09	PLAN & LONGITUDINAL SECTION CH 9000-10500
19212-C10	PLAN & LONGITUDINAL SECTION CH 10500-12000
19212-C11	PLAN & LONGITUDINAL SECTION CH 12000-13500
19212-C12	PLAN & LONGITUDINAL SECTION CH 13500-15000
19212-C13	PLAN & LONGITUDINAL SECTION CH 15000-16500
19212-C14	PLAN & LONGITUDINAL SECTION CH 16500-18000
19212-C15	PLAN & LONGITUDINAL SECTION CH 18000-19500
19212-C16	PLAN & LONGITUDINAL SECTION CH 19500-21000
19212-C17	PLAN & LONGITUDINAL SECTION CH 21000-22500
19212-C18	PLAN & LONGITUDINAL SECTION CH 22500-24000
19212-C19	PLAN & LONGITUDINAL SECTION CH 24000-25500
19212-C20	PLAN & LONGITUDINAL SECTION CH 25500-27000
19212-C21	PLAN & LONGITUDINAL SECTION CH 27000-28500
19212-C22	PLAN & LONGITUDINAL SECTION CH 28500-30000
19212-C23	PLAN & LONGITUDINAL SECTION CH 30000-31500
19212-C24	PLAN & LONGITUDINAL SECTION CH 31500-33000
19212-C25	PLAN & LONGITUDINAL SECTION CH 33000-34500
19212-C26	PLAN & LONGITUDINAL SECTION CH 34500-36000
19212-C27	PLAN & LONGITUDINAL SECTION CH 36000-37500
19212-C28	PLAN & LONGITUDINAL SECTION CH 37500-39000
19212-C29	PLAN & LONGITUDINAL SECTION CH 39000-40500
19212-C30	PLAN & LONGITUDINAL SECTION CH 40500-42000
19212-C31	PLAN & LONGITUDINAL SECTION CH 42000-43500
19212-C32	PLAN & LONGITUDINAL SECTION CH 43500-45000
19212-C33	PLAN & LONGITUDINAL SECTION CH 45000-46500
19212-C34	PLAN & LONGITUDINAL SECTION CH 46500-48000
19212-C35	PLAN & LONGITUDINAL SECTION CH 48000-49500
19212-C36	PLAN & LONGITUDINAL SECTION CH 49500-51000
19212-C37	PLAN & LONGITUDINAL SECTION CH 51000-52500
19212-C38	PLAN & LONGITUDINAL SECTION CH 52500-54000
19212-C39	PLAN & LONGITUDINAL SECTION CH 54000-55500
19212-C40	PLAN & LONGITUDINAL SECTION CH 55500-57000
19212-C41	PLAN & LONGITUDINAL SECTION CH 57000-58500
19212-C42	PLAN & LONGITUDINAL SECTION CH 58500-60000
19212-C43	PLAN & LONGITUDINAL SECTION CH 60000-61500
19212-C44	PLAN & LONGITUDINAL SECTION CH 61500-63000
19212-C45	McARTHUR RIVER CULVERT (OPTION A & C)
19212-C46	GLYDE RIVER CULVERT (OPTION A & C)
19212-C47	CULVERT DETAILS
19212-C48	McARTHUR RIVER & GLYDE RIVER FLOODWAYS (OPTION B)
19212-C49	CARPENTARIA HIGHWAY INTERSECTION

STANDARD DRAWINGS	
DRG. NO.	DESCRIPTION
C(S)1300	FLEXIBLE GUIDE POSTS
C(S)1301	STANDARD FLOOD GUAGE POSTS
C(S)1306	STOCK FENCE
C(S)1314	STANDARD CATTLE GRID (WITHOUT APPROACH SLAB)
C(S)1315	STANDARD CATTLE GRID - DETAILS



SITE PLAN

1:10000 for A3 Size Plot

A	FOR TENDER PURPOSES ONLY			5/97	
No.	Revision	Engineer	Approved	Date	M/Film

Gutteridge Haskins & Davey Pty Ltd

60 Mitchell Street, Darwin NT 0800

Scale: AS SHOWN

Designed: B.TAN 5/97 Engineer: C.WILLANDERS 5/97

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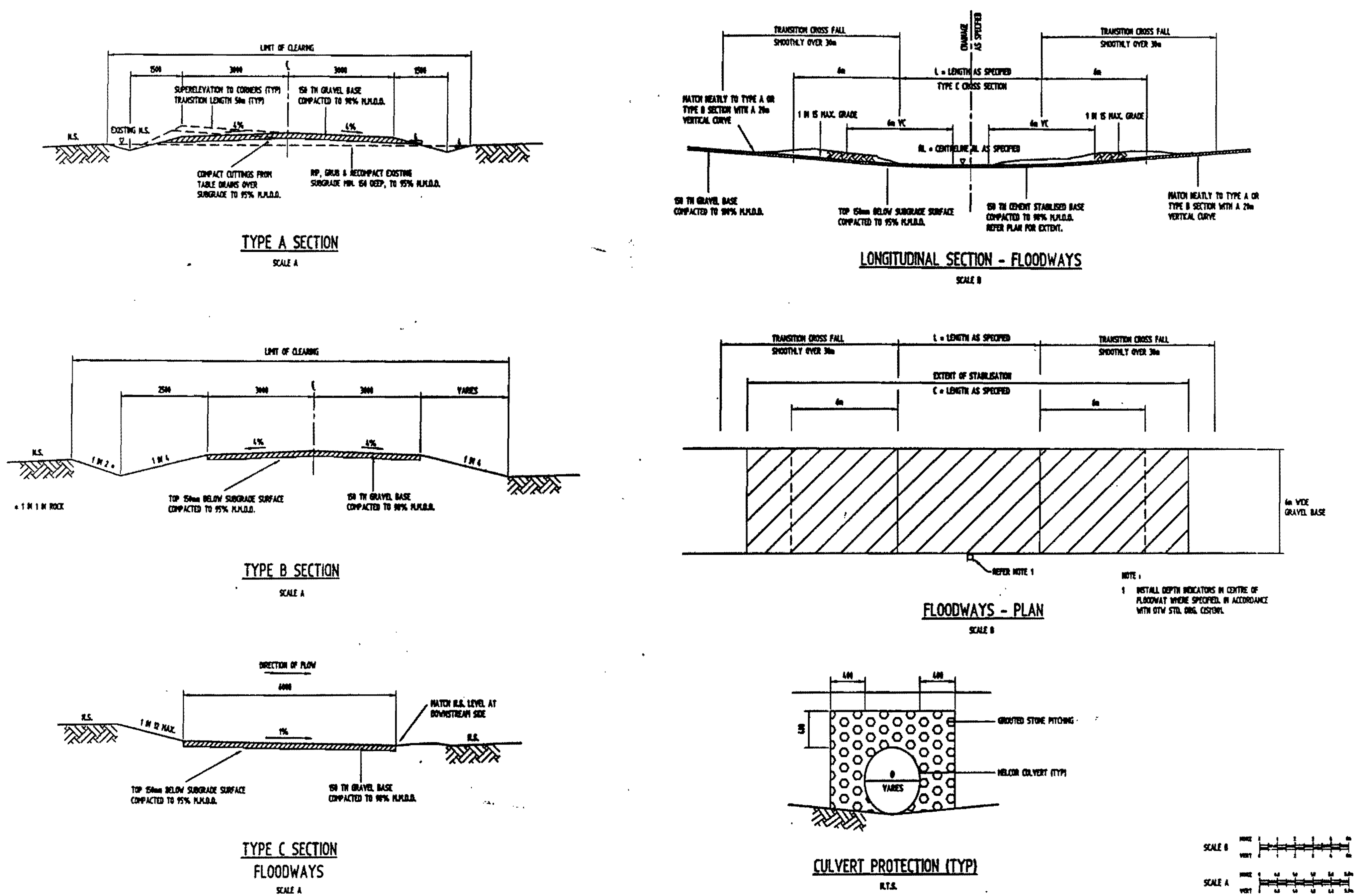
LOCALITY PLAN, SITE PLAN AND SCHEDULE OF DRAWINGS

A1 Drg. No. 19212-C00 Rev A



LIMIT OF CLEARING
SUPERELEVATION TO CORNERS (TYP)
TRANSITION LENGTH 50m (TYP)
150 TH GRAVEL BASE COMPACTED TO 98% M.M.D.D.
EXISTING N.S.
N.S.
4%
COMPACT CUTTINGS FROM TABLE DRAINS OVER SUBGRADE TO 95% M.M.D.D.
RIP, GRUB & RECOMPACT EXISTING SUBGRADE MIN. 150 DEEP, TO 95% M.M.D.D.
TYPE A SECTION
SCALE A
TRANSITION CROSS FALL SMOOTHLY OVER 30m
CHAINAGE AS SPECIFIED
L = LENGTH AS SPECIFIED
TYPE C CROSS SECTION
MATCH NEATLY TO TYPE A OR TYPE B SECTION WITH A 20m VERTICAL CURVE
1 IN 15 MAX. GRADE
6m VC
RL = CENTRELINE RL AS SPECIFIED
150 TH GRAVEL BASE COMPACTED TO 98% M.M.D.D.
TOP 150mm BELOW SUBGRADE SURFACE COMPACTED TO 95% M.M.D.D.
150 TH CEMENT STABILISED BASE COMPACTED TO 98% M.M.D.D. REFER PLAN FOR EXTENT.
LONGITUDINAL SECTION - FLOODWAYS
SCALE B
LIMIT OF CLEARING
2500
3000
VARIES
1 IN 2
1 IN 4
TOP 150mm BELOW SUBGRADE SURFACE COMPACTED TO 95% M.M.D.D.
150 TH GRAVEL BASE COMPACTED TO 98% M.M.D.D.
TYPE B SECTION
SCALE A
EXTENT OF STABILISATION
6m WIDE GRAVEL BASE
REFER NOTE 1
NOTE :
1 INSTALL DEPTH INDICATORS IN CENTRE OF FLOODWAY WHERE SPECIFIED, IN ACCORDANCE WITH DTW STD. DRG. CS5001.
FLOODWAYS - PLAN
SCALE B
DIRECTION OF FLOW
6000
1 IN 12 MAX.
1%
MATCH N.S. LEVEL AT DOWNSTREAM SIDE
TOP 150mm BELOW SUBGRADE SURFACE COMPACTED TO 95% M.M.D.D.
150 TH GRAVEL BASE COMPACTED TO 98% M.M.D.D.
TYPE C SECTION
FLOODWAYS
SCALE A
400
GROUTED STONE PITCHING
HELCOR CULVERT (TYP)
VARIES
CULVERT PROTECTION (TYP)
N.T.S.
SCALE B
SCALE A

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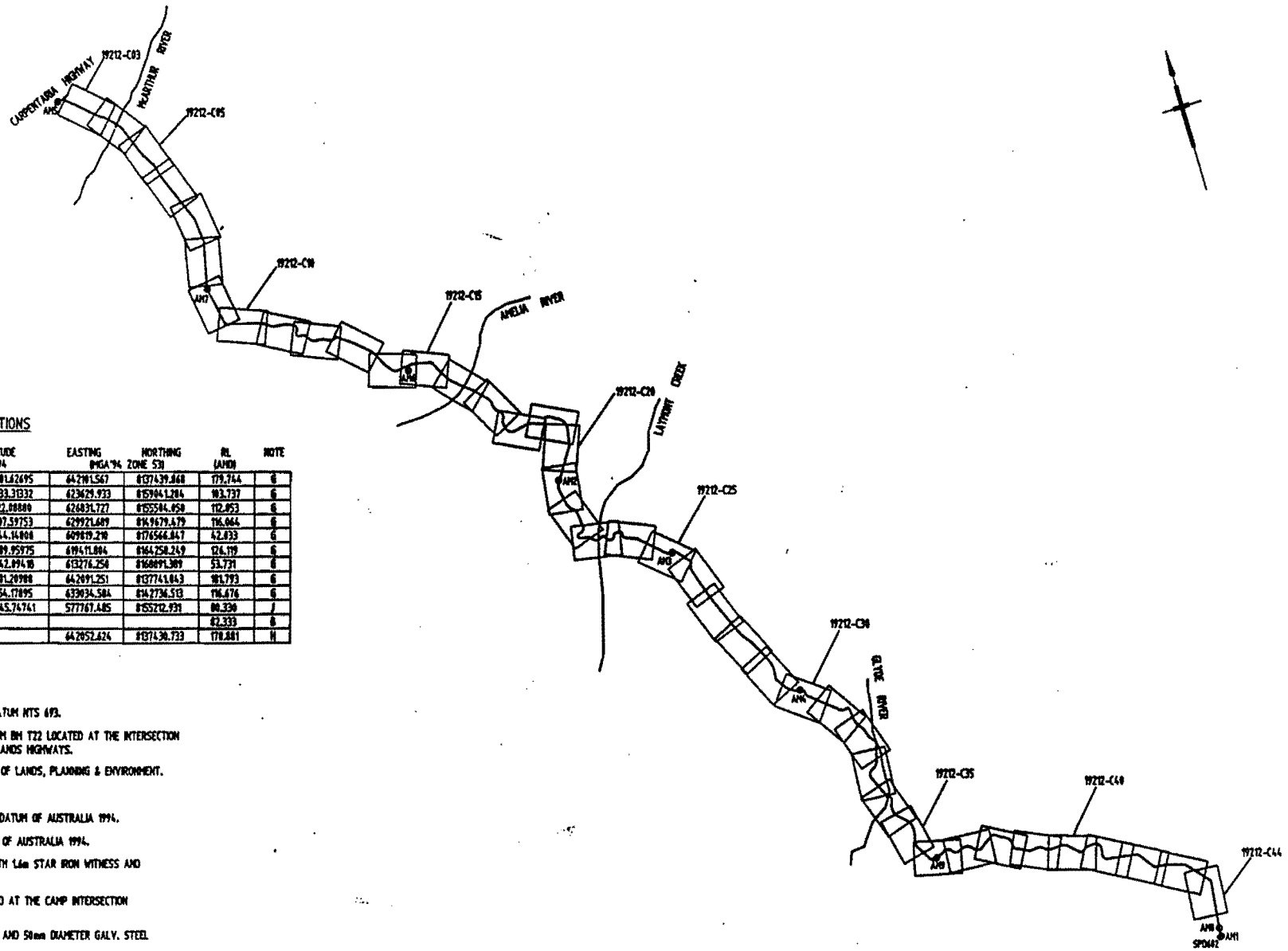
TYPE CROSS SECTIONS AND DETAILS

A1 Drg. No. 19212-C01 Rev A



SCHEDULE OF SURVEY CONTROL STATIONS

STATION	LATITUDE GDA'94	LONGITUDE GDA'94	EASTING MGA'94 ZONE 53	NORTHING	RL (AHD)	NOTE
AM1	S 16 50 31.34420	E 136 20 01.62695	642981.567	8137439.868	179.744	G
AM2	S 16 50 52.38093	E 136 09 33.31332	623429.933	8136941.284	183.737	G
AM3	S 16 48 46.77801	E 136 11 22.08880	626831.727	8135584.850	172.853	G
AM4	S 16 43 55.67926	E 136 13 07.59753	629921.689	8134679.679	176.044	G
AM5	S 16 29 24.50587	E 136 01 44.14808	609819.290	8176566.847	42.033	G
AM6	S 16 36 03.33699	E 136 07 09.95975	619411.884	8164258.249	124.119	G
AM7	S 16 33.33.66941	E 136 03 42.09410	613276.250	8160891.389	53.731	G
AM8	S 16 50 21.54884	E 136 20 01.20988	642091.251	8137741.843	181.793	G
AM9	S 16 47 48.94342	E 136 16 54.17895	639034.584	8142736.513	176.676	G
NTS693	S 16 41 03.92545	E 135 43 45.74761	577767.485	8155212.931	80.330	J
BM T22					82.333	B
SP0602			642052.624	8137430.733	178.881	H

NOTES:

A) DATUM POINT FOR HORIZONTAL DATUM NTS 693.

B) DATUM POINT FOR VERTICAL DATUM BM T22 LOCATED AT THE INTERSECTION OF THE CARPENTARIA AND TABLELANDS HIGHWAYS.

C) DATUM SOURCE FROMDEPARTMENT OF LANDS, PLANNING & ENVIRONMENT.

D) SURVEY CONDUCTED BY G.P.S.

E) GDA'94 REFERS TO THE GEODETIC DATUM OF AUSTRALIA 1994.

F) MGA'94 REFERS TO THE MAP GRID OF AUSTRALIA 1994.

G) STATION IS A 0.6m STAR IRON WITH 1.6m STAR IRON WITNESS AND STATION IDENTIFICATION.

H) SPIKE IN ℄ OF EXISTING ROAD END AT THE CAMP INTERSECTION WITH INTERNAL ROADS.

J) CONC. BLOCK WITH BRASS PLAQUE AND 50mm DIAMETER GALV. STEEL WITNESS 1.6 HIGH.

SCALE

No.	Revision	Engineer	Approved	Date	M/Fldr
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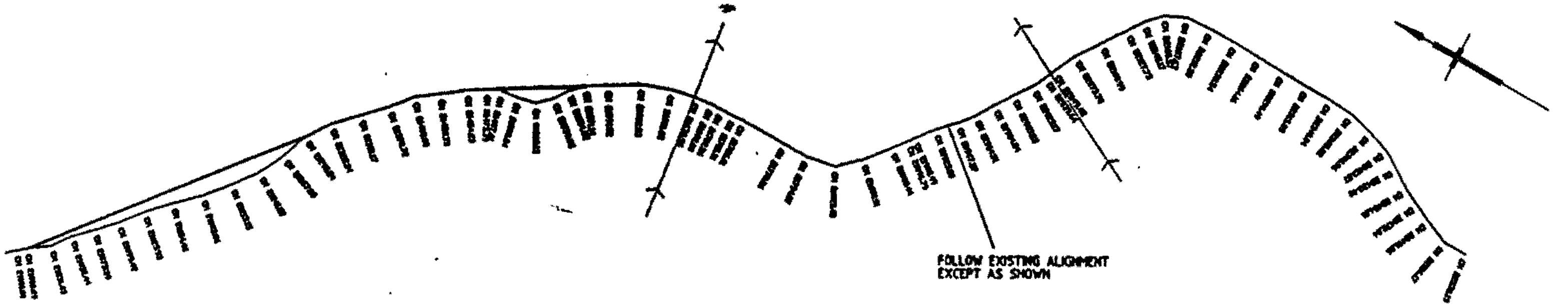
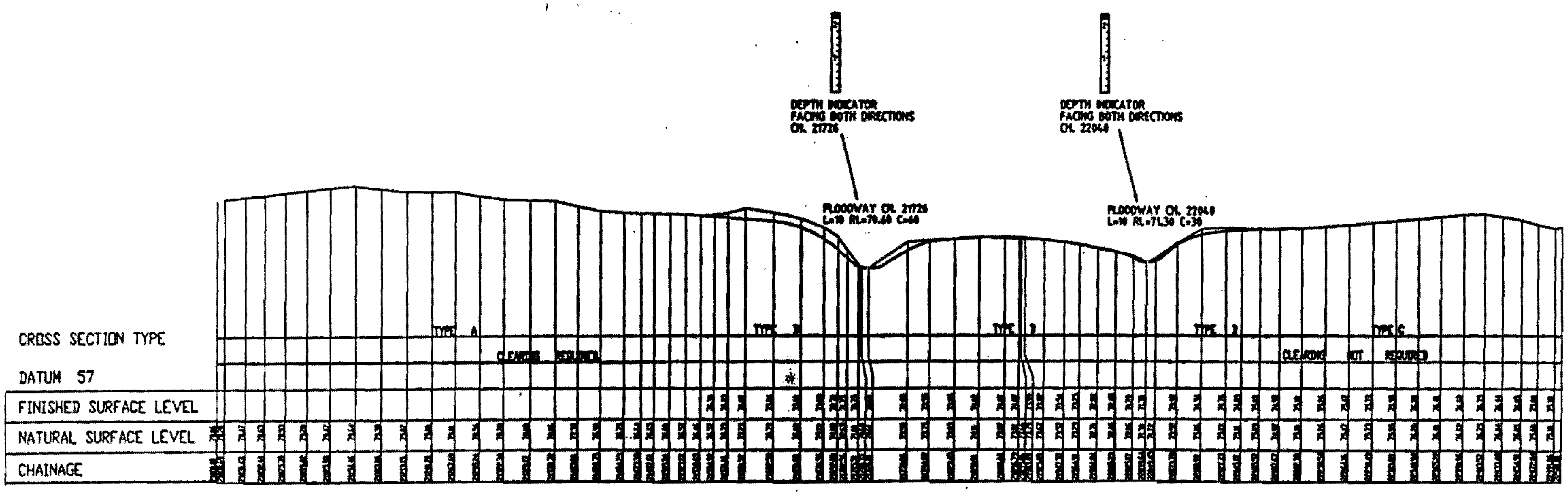
COMPILATION PLAN AND SURVEY DATA

Size A1 | Drg. No. 19212-C02 | Rev A

DO NOT SCALE



PLAN



LONGITUDINAL SECTION

SCALE

A	FOR TENDER PURPOSES ONLY			5/97	
No.	Revision	Engineer	Approved	Date	M/Film

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MERLIN PROJECT ACCESS ROAD

PLAN AND LONGITUDINAL SECTION
CH 21000 - 22500

A1 Drg. No. 19212-C17 Rev A

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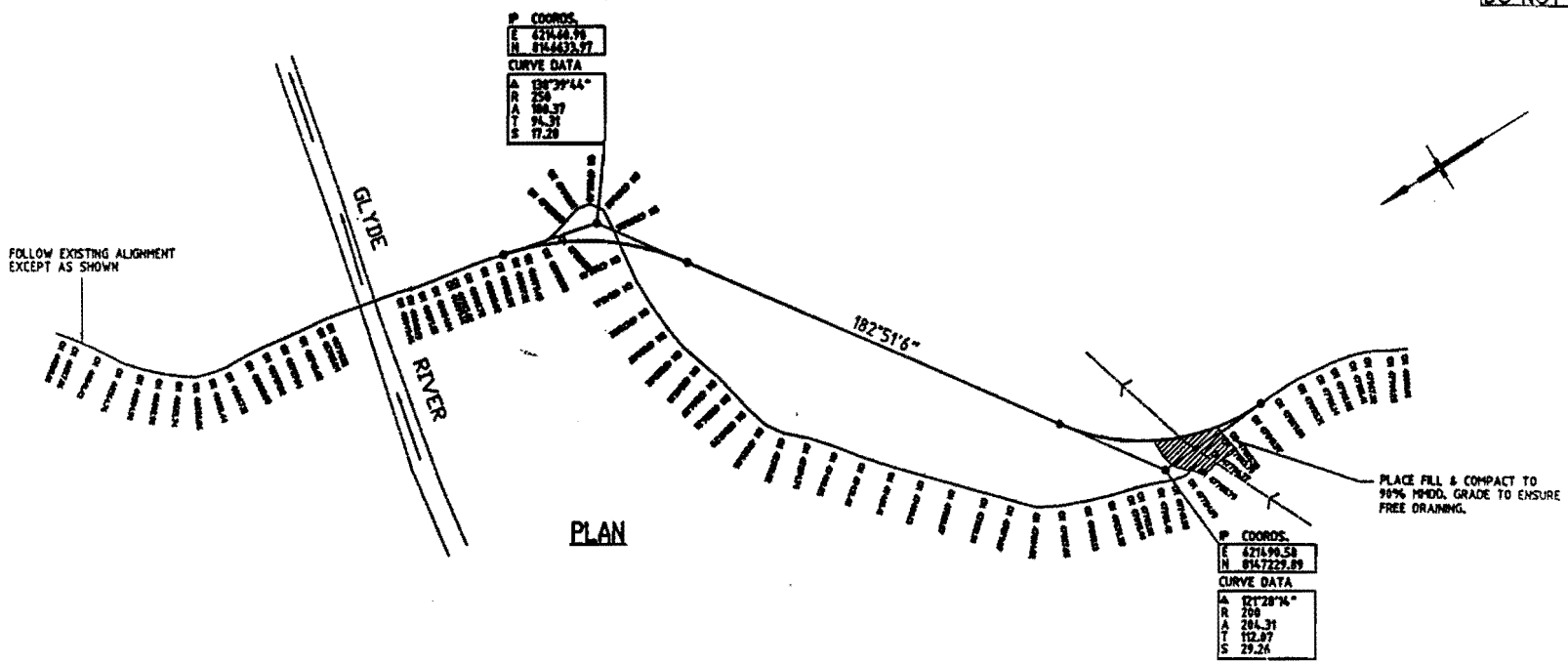
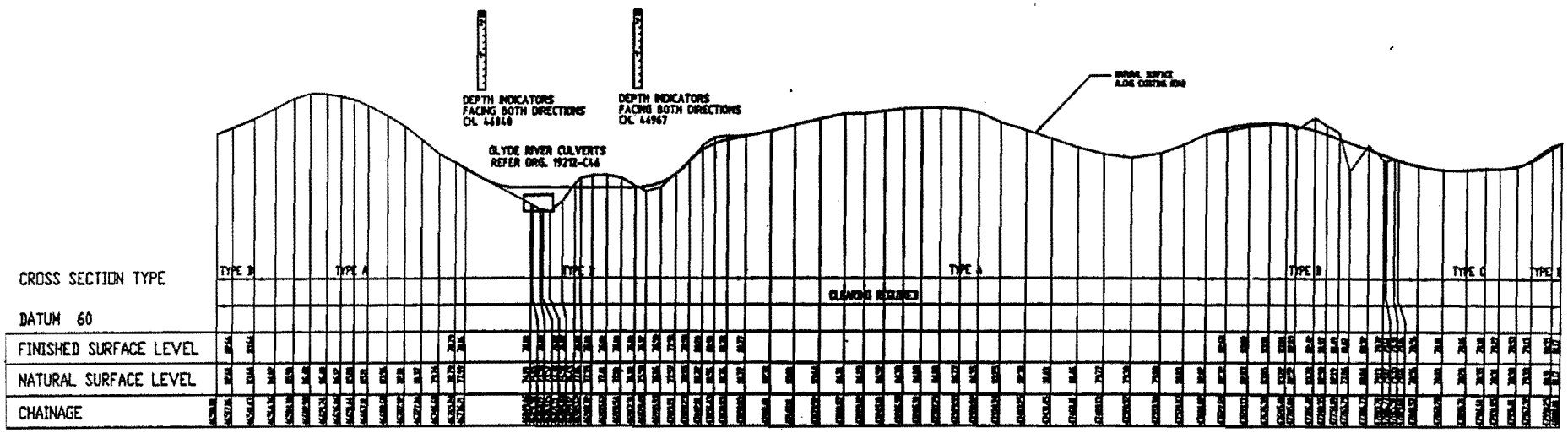


PLAN



LONGITUDINAL SECTION

SCALE

No.	Revision – Notes on CAD do not amend by hand	Engineer	Approved	Date	M/Film
A	FOR TENDER PURPOSES ONLY			5/97	

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GHD

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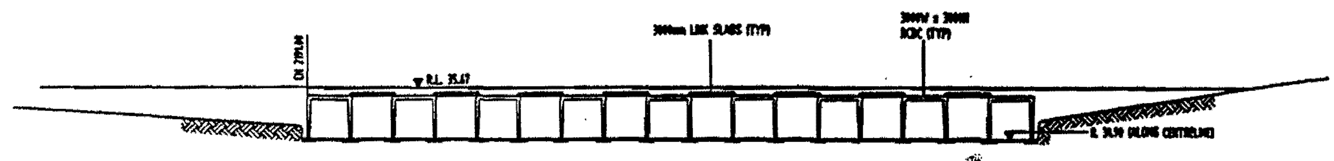
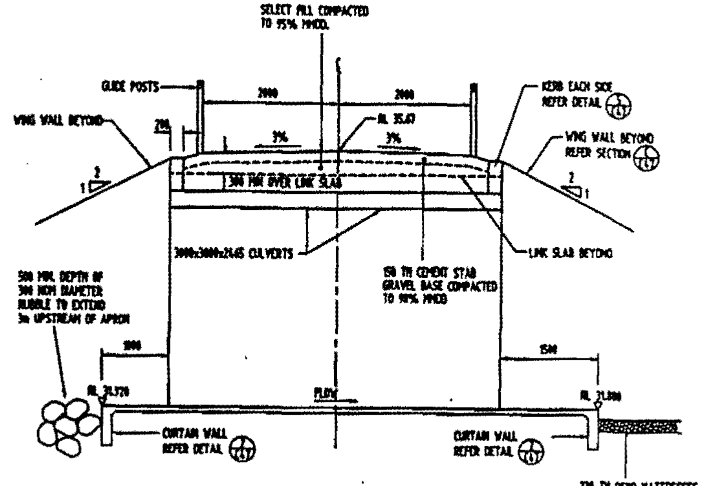
MERLIN PROJECT ACCESS ROAD
PLAN AND LONGITUDINAL SECTION
CH 46500 - 48000

Size A1 | Drg. No. 19212-C34 | Rev A

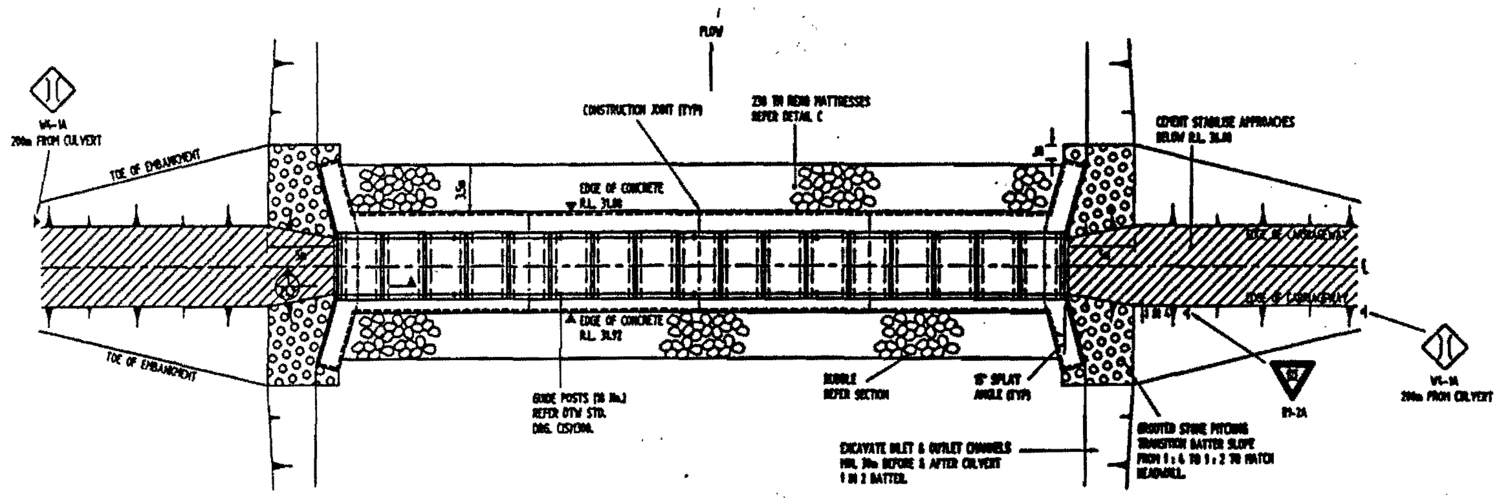
DO NOT SCALE



LONGITUDINAL SECTION
SCALE B



CROSS SECTION - CULVERT
SCALE A



PLAN
SCALE B

OPTION A: AS DRAWN

OPTION C:
- 7/3000W x 2100H RCBC IN LIEU OF 9/3000W x 3000H RCBC.
- 6/3000 LINK SLABS IN LIEU OF 8/3000 LINK SLABS.
- CENTRELINE RL OVER CULVERTS 34.77.

SCALE B (1:400 for A1 Size Plot)

SCALE A (1:40 for A1 Size Plot)

No.	Revision	Engineer	Approved	Date	M/Film
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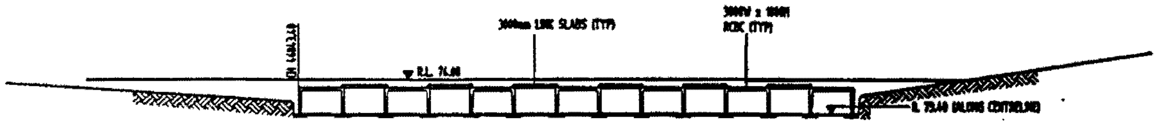
McARTHUR RIVER CULVERT
PLAN AND DETAILS (OPTION A & C)

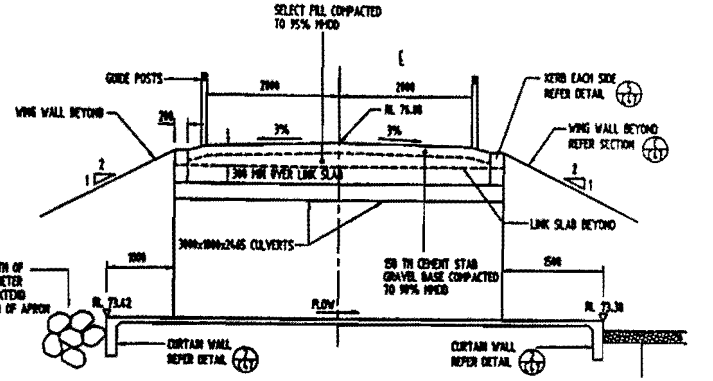
A1 Drg. No. 19212-C45

DO NOT SCALE



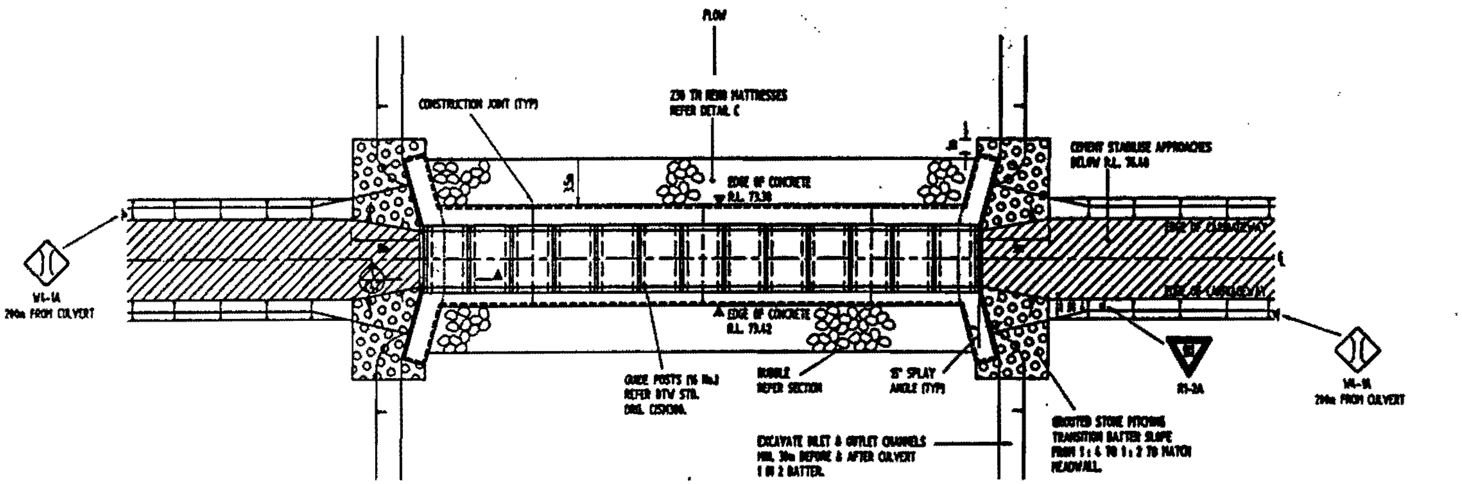
LONGITUDINAL SECTION

SCALE B



TYPICAL SECTION - CULVERT

SCALE A



PLAN

SCALE B

OPTION A: AS DRAWN

OPTION C:
- 4/3000W x 1500H RCBC IN LIEU OF 7/3000W x 1800H RCBC.
- 3/3000 LINK SLABS IN LIEU OF 6/3000 LINK SLABS.
- CENTRELINE RL OVER CULVERTS 75.70

SCALE B: (1:800 for A1 Size Plot)

SCALE A: (1:40 for A1 Size Plot)

No.	Revision	Engineer	Approved	Date	M/Film
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Gutteridge Haskins & Davey Pty Ltd

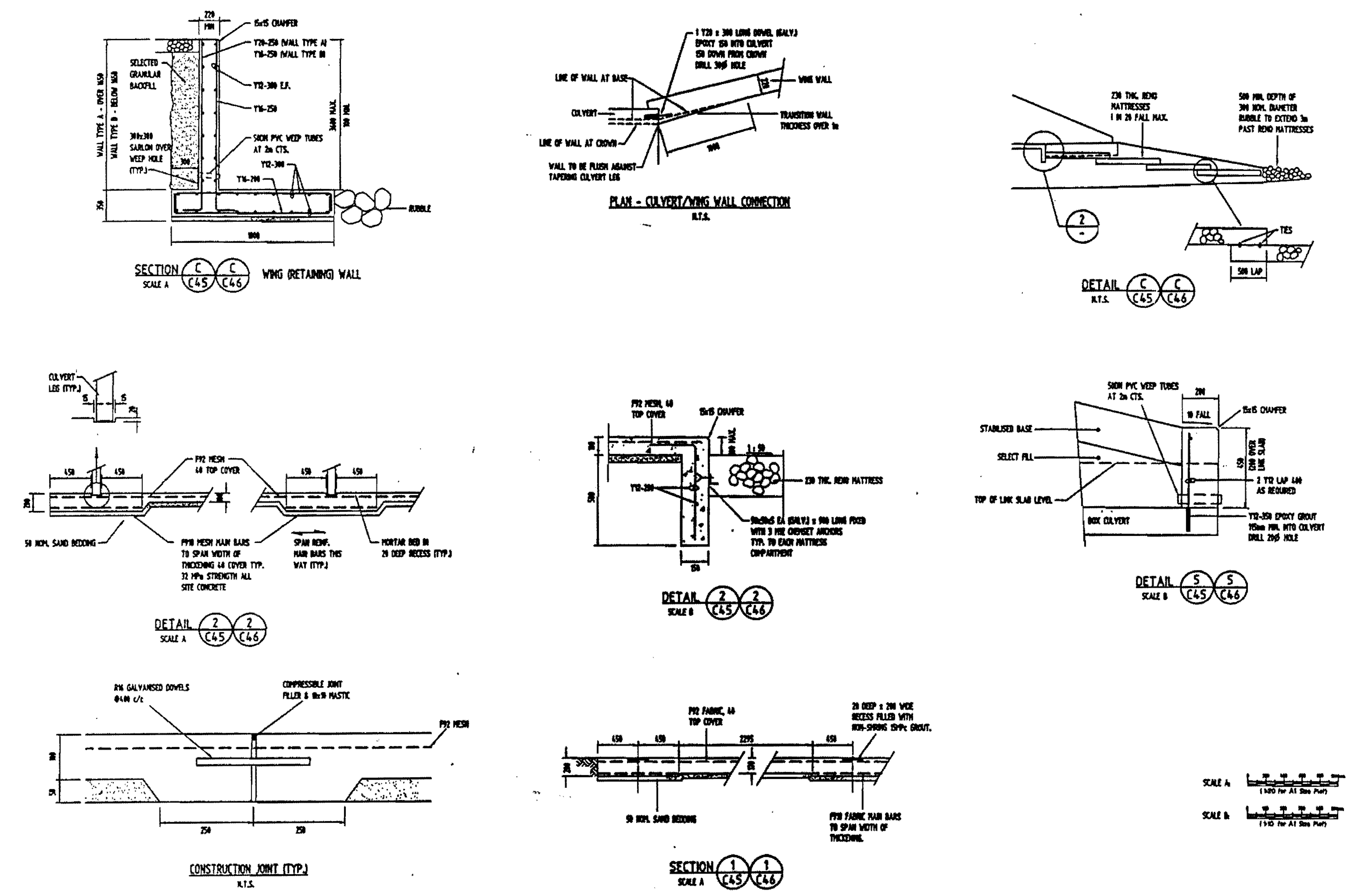
Scale: AS SHOWN

ASHTON MINING LTD.
MERLIN PROJECT ACCESS ROAD

GLYDE RIVER CULVERT
PLAN AND DETAILS (OPTION A & C)

A1 Drg. No. 19212-C46

DO NOT SCALE



15x15 CHAMFER
Y20-250 (WALL TYPE A)
Y16-250 (WALL TYPE B)
SELECTED GRANULAR BACKFILL
Y12-300 E.F.
Y16-250
50DIA PVC WEEP TUBES AT 2m CTS.
300x300 SARLON OVER WEEP HOLE (TYP.)
RUBBLE
WALL TYPE A - OVER 1650
WALL TYPE B - BELOW 1650
SECTION C C45 C46 WING (RETAINING) WALL
SCALE A
LINE OF WALL AT BASE
CULVERT
LINE OF WALL AT CROWN
WALL TO BE FLUSH AGAINST TAPERING CULVERT LEG
WING WALL
TRANSITION WALL THICKNESS OVER 1m
PLAN - CULVERT/WING WALL CONNECTION
N.T.S.
230 THK. RENO MATTRESSES 1 IN 20 FALL MAX.
500 MIN. DEPTH OF 300 NOM. DIAMETER RUBBLE TO EXTEND 3m PAST RENO MATTRESSES
TIES
500 LAP
DETAIL C C45 C46
N.T.S.
CULVERT LEG (TYP.)
F92 MESH 40 TOP COVER
50 NOM. SAND BEDDING
SPAN REINF. MAIN BARS THIS WAY (TYP.)
MORTAR BED IN 20 DEEP RECESS (TYP.)
32 MPa STRENGTH ALL SITE CONCRETE
DETAIL 2 C45 C46
SCALE A
F92 MESH, 40 TOP COVER
15x15 CHAMFER
230 THK. RENO MATTRESS
DETAIL 2 C45 C46
SCALE B
50DIA PVC WEEP TUBES AT 2m CTS.
15x15 CHAMFER
STABILISED BASE
SELECT FILL
TOP OF LINK SLAB LEVEL
BOX CULVERT
2 Y12 LAP 400 AS REQUIRED
DETAIL S C45 C46
SCALE B
R16 GALVANISED DOWELS @400 c/c
COMPRESSIBLE JOINT FILLER & 10x10 MASTIC
F92 MESH
CONSTRUCTION JOINT (TYP.)
N.T.S.
F92 FABRIC, 40 TOP COVER
50 NOM. SAND BEDDING
SECTION 1 C45 C46
SCALE A
SCALE A
SCALE B

A	FOR TENDER PURPOSES ONLY			5/97	
No.	Revision	Engineer	Approved	Date	M/Film

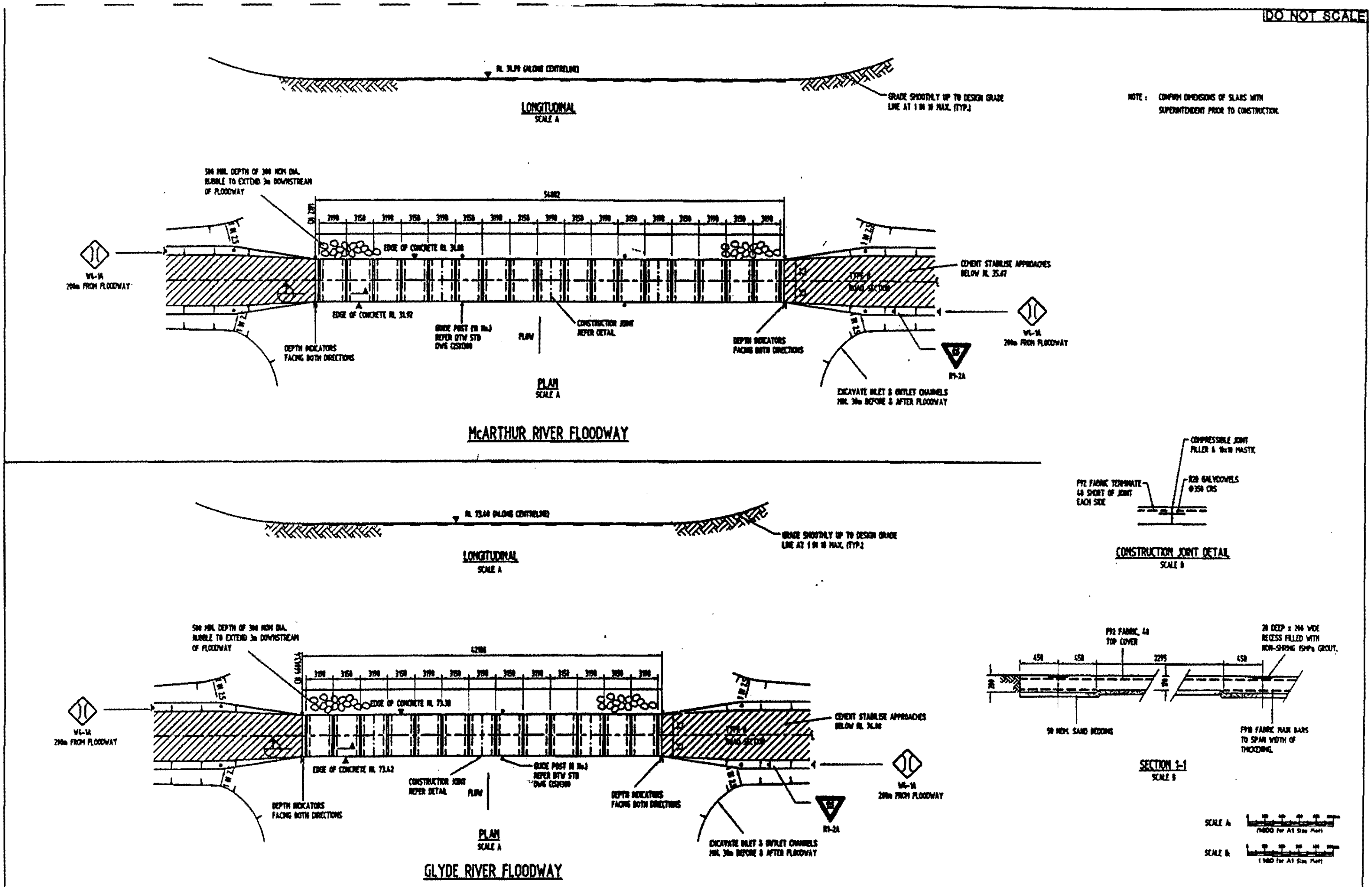
Gutteridge Haskins & Davey Pty Ltd

Scale: AS SHOWN

ASHTON MINING LTD.
MERLIN PROJECT ACCESS ROAD

CULVERT DETAILS

A1 Drg. No. 19212-C47


DO NOT SCALE
LONGITUDINAL
SCALE A
GRADE SMOOTHLY UP TO DESIGN GRADE LINE AT 1 IN 10 MAX. (TYP.)
NOTE : CONFIRM DIMENSIONS OF SLABS WITH SUPERINTENDENT PRIOR TO CONSTRUCTION.
500 MIN. DEPTH OF 300 NOM DIA. RUBBLE TO EXTEND 3m DOWNSTREAM OF FLOODWAY
51402
EDGE OF CONCRETE RL 31.88
EDGE OF CONCRETE RL 31.92
W4-1A
200m FROM FLOODWAY
CEMENT STABILISE APPROACHES BELOW RL 35.07
TYPE 6 ROAD SECTION
GUIDE POST (10 No.) REFER DTW STD DWG CS5200
FLOW
CONSTRUCTION JOINT REFER DETAIL
DEPTH INDICATORS FACING BOTH DIRECTIONS
R1-2A
EXCAVATE INLET & OUTLET CHANNELS MIN. 30m BEFORE & AFTER FLOODWAY
PLAN
SCALE A
McARTHUR RIVER FLOODWAY
COMPRESSIBLE JOINT FILLER & 10x10 MASTIC
F92 FABRIC TERMINATE 40 SHORT OF JOINT EACH SIDE
R20 GALVDOWELS @350 CRS
CONSTRUCTION JOINT DETAIL
SCALE B
42186
EDGE OF CONCRETE RL 73.38
EDGE OF CONCRETE RL 73.42
CEMENT STABILISE APPROACHES BELOW RL 76.08
F92 FABRIC, 40 TOP COVER
20 DEEP x 200 WIDE RECESS FILLED WITH NON-SHRINK 15MPa GROUT.
50 NOM. SAND BEDDING
F918 FABRIC MAIN BARS TO SPAN WIDTH OF THICKENING.
SECTION 1-1
SCALE B
SCALE A:
SCALE B:
GLYDE RIVER FLOODWAY

No.	Revision	Engineer	Approved	Date	M/Film
A	FOR TENDER PURPOSES ONLY			5/97	

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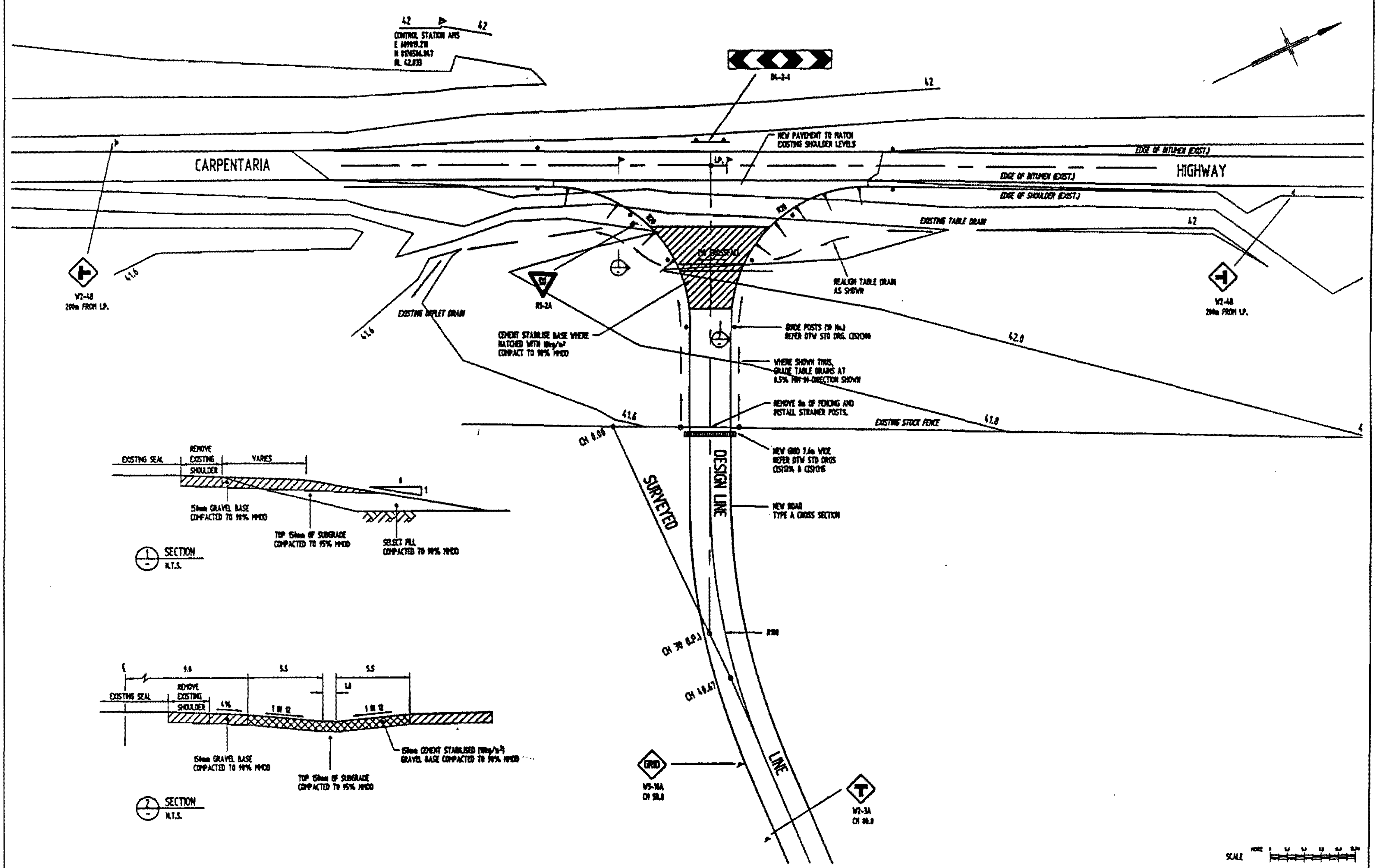
McARTHUR RIVER & GLYDE RIVER FLOODWAYS (OPTION B)

A1 Drg. No. 19212-C48

DO NOT SCALE



CONTROL STATION AMS
D4-2-1
NEW PAVEMENT TO MATCH EXISTING SHOULDER LEVELS
CARPENTARIA
HIGHWAY
EDGE OF BITUMEN (EXIST.)
EDGE OF SHOULDER (EXIST.)
EXISTING TABLE DRAIN
REALIGN TABLE DRAIN AS SHOWN
W2-4B
200m FROM I.P.
R1-2A
EXISTING OUTLET DRAIN
CEMENT STABILISE BASE WHERE MATCHED WITH 80kg/m² COMPACT TO 98% MMDD
GUIDE POSTS (10 No.)
WHERE SHOWN THIS, GRADE TABLE DRAINS AT 0.5% MIN IN DIRECTION SHOWN
REMOVE 8m OF FENCING AND INSTALL STRAINER POSTS.
EXISTING STOCK FENCE
NEW GRID 7.4m WIDE
NEW ROAD TYPE A CROSS SECTION
SURVEYED
DESIGN LINE
LINE
CH 0.00
CH 30 (I.P.)
CH 40.67
W5-16A
W2-3A
EXISTING SEAL
REMOVE EXISTING SHOULDER
VARIES
150mm GRAVEL BASE COMPACTED TO 98% MMDD
TOP 150mm OF SUBGRADE COMPACTED TO 95% MMDD
SELECT FILL COMPACTED TO 98% MMDD
SECTION 1
N.T.S.
1 IN 12
150mm CEMENT STABILISED GRAVEL BASE COMPACTED TO 98% MMDD
SECTION 2
N.T.S.
SCALE

No.	Revision	Engineer	Approved	Date	M/Film
A	FOR TENDER PURPOSES ONLY			5/97	

Gutteridge Haskins & Davey Pty Ltd (GHD)

Scale: AS SHOWN

ASHTON MINING LTD.
MERLIN PROJECT ACCESS ROAD

CARPENTARIA HIGHWAY INTERSECTION SETOUT DETAILS

A1 Drg. No. 19212-C49

APPENDIX D

Ashton Mining Limited
A.C.N. 005 460 964

OCCUPATIONAL HEALTH AND SAFETY POLICY

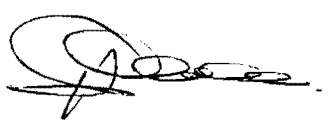
Ashton is committed to establishing and maintaining the highest possible standards of occupational health, safety and welfare for its employees. Emphasis is to be given to the prevention of accidents, injury and occupational disease.

Management and supervisors at all levels should regard health and safety at the workplace as one of their highest priorities. They have the prime responsibility for ensuring that employees are given instruction on correct techniques for performing their job; incorporating instruction on safe working practices and procedures, as well as ensuring an awareness of all the hazards associated with their work.

Every employee has a responsibility for accident and injury prevention and will be encouraged to actively participate in improving standards of workplace health and safety.

Safety committees are to be established at the various workplaces throughout the Company and management will regularly consult and co-operate with their groups of employees on matters relating to workplace health and safety.

Our objective is to create a co-operative approach to improving occupational health and safety. To be effective, it should be seen as a responsibility by all employees of Ashton.



R. J. Robinson
Chief Executive and Managing Director

APPENDIX E

MPL

division of Cryston Holdings Pty Ltd ACN 009 446 575

QUALITY SYSTEM
CERTIFIED TO
ISO 9002
WA/SA REGION

REGN. No. 6608

CERTIFICATE OF ANALYSIS

TESTING FACILITY: PERTH

CLIENT NAME Ashton Mining Ltd
ADDRESS PO Box 1068
Cloverdale

WA
6105

JOB No. : 970435

ATTENTION: Michael Bohm - Project Manager - Merlin

FAX NO: 334 6480

ORDER NO: 9718

SAMPLED BY: AS RECEIVED

NUMBER OF SAMPLES 2
DATE RECEIVED 21/02/97

MESSAGES This certificate covers the analytical results for the above samples and comprises this release cover and the following pages.

MPL Value their Clients
For further interpretation of results or free advice on occupational and environmental issues do not hesitate to contact our specialists on (09) 3172505.

Approved Signatory
06/03/97

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WA/NT
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Fax (09) 317 2368

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Fax (08) 8443 8003

ACT/NSW
Phone (06) 288 2884
Fax (06) 287 1937

VIC
Phone (03) 9315 1900
Fax (03) 9315 3711

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QUALITY SYSTEM
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ISO 9002
WA/SA REGION

REGN. No. 6608

CERTIFICATE OF ANALYSIS

TESTING FACILITY: PERTH

CLIENT : Ashton Mining Ltd
DATE RECEIVED: 21/02/97 JOB NO : 970435
SAMPLED BY : AS RECEIVED

TEST METHOD: Waters analysis in accordance with the procedures published by the American Public Health Association (APHA,1995), MPL Laboratories WILAB 5.0

Lab No. : M001
Client ID : Camp Bore - Sample A
20/02/97

	RECOMM. MAXIMUM	UNIT	ANALYSIS RESULT
Conductivity	780	uS/cm	457
TDS-Calculated	500	mg/L	295
Sodium	180	mg/L	78
Potassium	N/S	mg/L	19
Calcium	N/S	mg/L	<1
Magnesium	N/S	mg/L	6
Hardness [CaCO3]	200	mg/L	25
Aluminium (Total)		mg/L	<0.1
Iron (Total)	0.3	mg/L	<0.05
Carbonate	N/S	mg/L	<1
BiCarbonate	N/S	mg/L	18
Nitrate (as N)		mg/L	<1
Chloride	250	mg/L	92
Sulphate	250	mg/L	48
pH	6.5 - 8.5		6.65
Total Alkalinity-Calc		mg/L	15
Total Suspend Solids		mg/L	<1
Iron (Residue)		mg/L	<0.05
Aluminium (Residue)		mg/L	<0.10

The recommended Maximums are taken from "Australian Drinking Water Guidelines" published by NHMRC and ARMC 1996.
N/S = No Specified Maximum
This report replaces report previously issued 05/03/97

Checked
Page 1 of 8

Approved Signatory
05/03/97

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REGN. No. 6608

CERTIFICATE OF ANALYSIS

TESTING FACILITY: PERTH

CLIENT : Ashton Mining Ltd
ATE RECEIVED: 21/02/97 JOB NO : 970435
AMPLED BY : AS RECEIVED

EST METHOD: Waters analysis in accordance with the procedures published by the American Public Health Association (APHA,1995), MPL Laboratories WILAB 5.0

Lab No. : M002
Client ID : Camp Bore - Sample B
20/02/97

	RECOMM.	UNIT	ANALYSIS RESULT
Conductivity	780	uS/cm	450
TDS-Calculated	500	mg/L	290
Sodium	180	mg/L	77
Potassium	N/S	mg/L	19
Calcium	N/S	mg/L	<1
Magnesium	N/S	mg/L	6
Hardness [CaCO3]	200	mg/L	25
Aluminium (Total)		mg/L	<0.1
Iron (Total)	0.3	mg/L	<0.05
Carbonate	N/S	mg/L	<1
BiCarbonate	N/S	mg/L	21
Nitrate (as N)		mg/L	<1
Chloride	250	mg/L	94
Sulphate	250	mg/L	46
pH	6.5 - 8.5		6.62
Total Alkalinity-Calc		mg/L	18
Total Suspend Solids		mg/L	<1
Iron (Residue)		mg/L	<0.05
Aluminium (Residue)		mg/L	<0.1

The recommended Maximums are taken from "Australian Drinking Water Guidelines" published by NHMRC and ARMC 1996.
N/S = No Specified Maximum
This report replaces report previously issued 05/03/97

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05/03/97

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REGN. No. 6608

CERTIFICATE OF ANALYSIS

TESTING FACILITY: PERTH

CLIENT : Ashton Mining Ltd
ATE RECEIVED: 21/02/97 JOB NO : 970435
AMPLED BY : AS RECEIVED

EST METHOD: Results determined by Inductively Coupled Plasma (ICP) Optical Emission Spectrometry (OES) and Mass Spectrometry (MS).

Lab No. : M001
Client ID : Camp Bore Sample A
20/02/97

ANALYTE	RESULT	UNIT
Copper	<0.02	mg/L
Lead	<0.05	mg/L
Zinc	0.02	mg/L
Cobalt	<0.02	mg/L
Nickel	<0.02	mg/L
Arsenic	<0.01	mg/L
Boron	0.04	mg/L
Silver	<0.01	mg/L
Chromium	<0.02	mg/L
Barium	0.30	mg/L
Berylium	<0.01	mg/L
Bismuth	<0.01	mg/L
Cadmium	<0.1	mg/L
Gallium	<0.01	mg/L
Germanium	<0.1	mg/L
Lithium	<0.01	mg/L
Manganese	<0.02	mg/L
Molybdenum	<0.01	mg/L
Phosphorous	1.0	mg/L
Antimony	<0.01	mg/L
Scandium	<0.02	mg/L
Tin	<0.1	mg/L
Strontium	0.03	mg/L

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CLIENT : Ashton Mining Ltd
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SAMPLED BY : AS RECEIVED

TEST METHOD: Results determined by Inductively Coupled Plasma (ICP) Optical Emission Spectrometry (OES) and Mass Spectrometry (MS).

Lab No. : M001
Client ID : Camp Bore Sample A
20/02/97

ANALYTE	RESULT	UNIT
Vanadium	<0.02	mg/L
Tungsten	<0.01	mg/L
Tantalum	<0.005	mg/L
Yttrium	<0.01	mg/L
Hafnium	<0.002	mg/L
Zirconium	<0.05	mg/L
Niobium	<0.01	mg/L
Lanthanum	<0.005	mg/L
Cerium	<0.005	mg/L
Praseodymium	<0.002	mg/L
Neodymium	<0.005	mg/L
Samarium	<0.005	mg/L
Europium	<0.002	mg/L
Gadolinium	<0.002	mg/L
Terbium	<0.002	mg/L
Dysprosium	<0.005	mg/L
Holmium	<0.002	mg/L
Erbium	<0.005	mg/L
Thulium	<0.002	mg/L
Ytterbium	<0.005	mg/L
Lutetium	<0.002	mg/L
Thorium	<0.005	mg/L
Uranium	<0.005	mg/L
Selenium	<0.1	mg/L

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TESTING FACILITY: PERTH

CLIENT : Ashton Mining Ltd
DATE RECEIVED: 21/02/97 JOB NO : 970435
SAMPLED BY : AS RECEIVED

TEST METHOD: Results determined by Inductively Coupled Plasma (ICP) Optical Emission Spectrometry (OES) and Mass Spectrometry (MS).

Lab No. : M001
Client ID : Camp Bore Sample A
20/02/97

ANALYTE	RESULT	UNIT
Rubidium	0.032	mg/L
Indium	<0.001	mg/L
Tellurium	<0.02	mg/L
Caesium	<0.005	mg/L
Rhenium	<0.01	mg/L
Thallium	<0.005	mg/L
Silicon	18	mg/L
Iron	<0.02	mg/L
Aluminium	<0.05	mg/L
Calcium	1.4	mg/L
Magnesium	8.7	mg/L
Titanium	<0.05	mg/L
Sodium	67	mg/L
Potassium	12	mg/L
Sulphur	17	mg/L

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CLIENT : Ashton Mining Ltd
ATE RECEIVED: 21/02/97 JOB NO : 970435
AMPLED BY : AS RECEIVED

TEST METHOD: Results determined by Inductively Coupled Plasma (ICP) Optical Emission Spectrometry (OES) and Mass Spectrometry (MS).

Lab No. : M002
Client ID : Camp Bore - Sample B
20/02/97

ANALYTE	RESULT	UNIT
Copper	<0.02	mg/L
Lead	<0.05	mg/L
Zinc	0.02	mg/L
Cobalt	<0.02	mg/L
Nickel	<0.02	mg/L
Arsenic	<0.01	mg/L
Boron	0.04	mg/L
Silver	<0.01	mg/L
Chromium	<0.02	mg/L
Barium	0.30	mg/L
Berylium	<0.01	mg/L
Bismuth	<0.01	mg/L
Cadmium	<0.1	mg/L
Gallium	<0.01	mg/L
Germanium	<0.1	mg/L
Lithium	<0.01	mg/L
Manganese	<0.02	mg/L
Molybdenum	<0.01	mg/L
Phosphorous	<0.5	mg/L
Antimony	<0.01	mg/L
Scandium	<0.02	mg/L
Tin	<0.1	mg/L
Strontium	0.03	mg/L

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TESTING FACILITY: PERTH

CLIENT : Ashton Mining Ltd
DATE RECEIVED: 21/02/97 JOB NO : 970435
SAMPLED BY : AS RECEIVED

TEST METHOD: Results determined by Inductively Coupled Plasma (ICP) Optical Emission Spectrometry (OES) and Mass Spectrometry (MS).

Lab No. : M002
Client ID : Camp Bore - Sample B
20/02/97

ANALYTE	RESULT	UNIT
Vanadium	<0.02	mg/L
Tungsten	<0.01	mg/L
Tantalum	<0.005	mg/L
Yttrium	<0.01	mg/L
Hafnium	<0.002	mg/L
Zirconium	<0.05	mg/L
Niobium	<0.01	mg/L
Lanthanum	<0.005	mg/L
Cerium	<0.005	mg/L
Praseodymium	<0.002	mg/L
Neodymium	<0.005	mg/L
Samarium	<0.005	mg/L
Europium	<0.002	mg/L
Gadolinium	<0.002	mg/L
Terbium	<0.002	mg/L
Dysprosium	<0.005	mg/L
Holmium	<0.002	mg/L
Erbium	<0.005	mg/L
Thulium	<0.002	mg/L
Ytterbium	<0.005	mg/L
Lutetium	<0.002	mg/L
Thorium	<0.005	mg/L
Uranium	<0.005	mg/L
Selenium	<0.1	mg/L

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TESTING FACILITY: PERTH

CLIENT : Ashton Mining Ltd
ATE RECEIVED: 21/02/97 JOB NO : 970435
AMPLED BY : AS RECEIVED

EST METHOD: Results determined by Inductively Coupled Plasma (ICP) Optical Emission Spectrometry (OES) and Mass Spectrometry (MS).

Lab No. : M002
Client ID : Camp Bore - Sample B
20/02/97

ANALYTE	RESULT	UNIT
Rubidium	0.034	mg/L
Indium	<0.001	mg/L
Tellurium	<0.02	mg/L
Caesium	<0.005	mg/L
Rhenium	<0.01	mg/L
Thallium	<0.005	mg/L
Silicon	17	mg/L
Iron	<0.02	mg/L
Aluminium	<0.05	mg/L
Calcium	1.5	mg/L
Magnesium	8.6	mg/L
Titanium	<0.05	mg/L
Sodium	66	mg/L
Potassium	13	mg/L
Sulphur	17	mg/L

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05/03/97

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APPENDIX F

SITE	DATE			LATITUDE	LONGITUDE

LOCALITY

STRUCTURAL FORMATION	ALTITUDE

HEIGHT CALCULATION

SPECIES (LAYER)	%	Ht	STR.	HEIGHT

PRIMARY GBH		OTHER GBH	
SPECIES	GBH	SPECIES	GBH

PHOTOS

COLLECTION NO:

RELEIF

- ☐ very high > 300 m
- ☐ high 90 - 300 m
- ☐ high 30 - 90 m
- ☐ very low 30 - 90 m
- ☐ extremely low < 9 m

SLOPE POSITION

- ☐ crest
- ☐ ridge crest
- ☐ wax. upper slope
- ☐ waning mid-slope
- ☐ simple slope
- ☐ waxing up-slope
- ☐ max. lower slope
- ☐ min. mid-slope
- ☐ flat
- ☐ open depression

SLOPE

- ☐ LE < 1%
- ☐ VE 1-3%
- ☐ GE 3-10%
- ☐ MO 10-32%
- ☐ ST 32-56%
- ☐ VS 56-100%
- ☐ PR > 100%

ASPECT

- ☐ nil
- ☐ north
- ☐ south
- ☐ east
- ☐ west

TOP SOIL

COLOUR

- ☐ whitish
- ☐ greyish
- ☐ mottled
- ☐ yellow
- ☐ yellow/brown
- ☐ brown
- ☐ red
- ☐ black

TEXTURE

- ☐ clay
- ☐ clay loam
- ☐ silt
- ☐ loam
- ☐ sandy loam
- ☐ sandy
- ☐ stony

LANDFORM ELEMENT

- ☐ bank
- ☐ beach
- ☐ beach ridge
- ☐ cliff footslope
- ☐ dam
- ☐ drainage depression
- ☐ dune
- ☐ footslope
- ☐ foredune
- ☐ gully
- ☐ hillcrest
- ☐ hillslope
- ☐ levee
- ☐ ox-bow
- ☐ plain
- ☐ scarp footslope
- ☐ stream bed
- ☐ swale
- ☐ swamp
- ☐ tidal flat

NOTES: (including any disturbances)

VRI	SITE:	SAMPLE:	DATE	RECD'S:	MAP :
LOCALITY:					

LAT:	LONG:	LANDFORM				SLOPE		NBP	ALT
		BIT	ELE	PTN		POS	CLASS		

SOILS					GEOLOGY					
OBS.	REL.	CODE	ADD	P.P. FORM	OBS	REL	CODE	CODE	ADD	H.UNIT
TOP SOL	TEX									

DISTURBANCE	STEM DENSITY		BA	RAINFOREST			
				COMP	LEAF	COMP	ORTH

B&W		PHU	PHOTO PTN
S			

E IIT	T1	T2	T3	S1	S2	Q
E PCC	T1	T2	T3	S1	S2	Q

ASSOC

EMERGENT	STEM DENSITY	BA

T1	STEM DENSITY	BA

T2	STEM DENSITY	BA

T3	STEM DENSITY	BA

S1	STEM DENSITY	BA

S2	STEM DENSITY	BA

SPECIES		1	2	3	4	5	
LITTER							
TOTAL							

PROFILE & NOTES

SPECIES		1	2	3	4	5	

Description:		
Site # :	Date:	GPS Location:
Altitude:		Photo # :
Aspect:		Topsoil Color:
Slope:		Topsoil Texture:
Slope Position:		Landform:
Disturbances:		

Layer:	Height:	CSR:

SPECIES	FM	#	/ ha	SPECIES	FM	#	/ ha

Layer:	Height:	CSR:

SPECIES	FM	#	/ ha	SPECIES	FM	#	/ ha

Layer:	Height:	CSR:

SPECIES	FM	#	/ ha	SPECIES	FM	#	/ ha

Description:		
Site # :	Date:	GPS Location:
Altitude:		Photo # :
Aspect:		Topsoil Color:
Slope:		Topsoil Texture:
Slope Position:		Landform:
Disturbances:		

Layer:	Height:	CSR:

SPECIES	FM	#	# / ha	SPECIES	FM	#	# / ha

Layer:	Height:	CSR:

SPECIES	FM	#	/ ha	SPECIES	FM	#	/ ha

Layer:	Height:	CSR:

SPECIES	FM	#	/ ha	SPECIES	FM	#	/ ha

Key to Growth Form of Plant Species

EMe	=	Emergent tree; woody plant with a single stem within 2 metres of the ground; evergreen.
EMd	=	Emergent tree; woody plant with a single stem within 2 metres of the ground; diciduous.
TRe	=	Tree; woody plant with a single stem within 2 metres of the ground; evergreen.
TRd	=	Tree; woody plant with a single stem within 2 metres of the ground; diciduous.
PM	=	Plam; usually single stemmed woody plants with a tuft of feather or fan shaped leaves arising from the apex. From the family Araceae (true palms), Cycadaceae or Pandanaceae.
SHa	=	Shrub; woody plant with multiple stems arising within 2 metres of the base; annual.
SHpe	=	Shrub; woody perennial plant with multiple stesm arising within 2 metres of the base; evergreen, including leafless plants.
SHpd	=	Shrub; woody perennial plant with multiple stems arising within 2 metres of the base; deciduous.
SHpaa	=	Shrub; woody perennial plant with multiple stems arising within 2 metres of the base; annual.
FOa	=	Forb; herbaceous or slightly woody plant; not a grass; annual.
FOpe	=	Forb; herbaceous or slightly woody plant; not a grass; perennial, evergreen.
FOpaa	=	Forb; herbaceous or slightly woody plant; not a grass; perennial with annual aerial parts.
CLa	=	Climber/Vine; climbing, twining or sprawling plant, usually with a woody stem; annual.
CLpe	=	Climber/Vine; climbing, twining or sprawling plant, usually with a woody stem; perennial, evergreen.
CLpd	=	Climber/Vine; climbing, twining or sprawling plant, usually with a woody stem; perennial, deciduous.
CLpaa	=	Climber/Vine; climbing, twining or sprawling plant, usually with a woody stem; perennial with annual aerial parts.
EP	=	Epiphyte; plants growing on another plant for support ect.
AQ	=	Aquatic; plants growing predominantly in water.
GRa	=	Grass; plants of the family Poaceae; annual.
GRp	=	Grass; plants of the family Poaceae; perennial.
SEa	=	Sedge; herbaceous plant normally with tufted habit and from the family Cyperaceae or Restionaceae; annual.
SEp	=	Sedge; herbaceous plant normally with tufted habit and from the family Cyperaceae or Restionaceae; perennial.
FEa	=	Fern; herbaceous plant usually with succulent feathery leaves from the Phylum Pteridophyta; annual.
FEpe	=	Fern; herbaceous plant usually with succulent feathery leaves from the Phylum Pteridophyta; perennial evergreen.
FEpaa	=	Fern; herbaceous plant usually with succulent feathery leaves from the Phylum Pteridophyta; perennial with annual aerial parts.
PAr	=	Parasite; root.
PAa	=	Parasite; aerial.

Key to Landscape Descriptors

LANDFORM ELEMENT
- Bank
- Beach
- Beach ridge
- Cliff footslope
- Dam
- Drainage Depression
- Dune
- Footslope
- Foredune
- Gully
- Hillcrest
- Hillslope
- Levee
- Ox-bow
- Plain
- Scarp footslope
- Stream bed
- Swale

RELIEF
- 300m+
- 100m+
- 50m+
- 10m+
- 10m-

SLOPE POSITION
- Crest
- Ridge
- Upper slope
- Mid-slope
- Lower slope
- Flat
- Open depression

SLOPE
- LE <1%
- VE 1-3%
- GE 3-10%
- MO 10-30%
- ST 30-55%
- VS 55-100%
- PR >100%

ASPECT
- Nil
- North
- South
- East
- West

TOP SOIL

Colour
- Whitish
- Greyish
- Mottled
- Yellow
- Yellow/Brown
- Brown
- Red
- Black

Texture
- Clay
- Clay loam
- Silt
- Loam
- Sandy Loam
- Sandy
- Gravelly
- Lateritic
- Stony
- Bare Rock

Key to Structural Classification of Vegetation Communities (after Walker & Hopkins, 1990).

Crown Separation	Touching Overlapping	Touching Slightly	Clearly Separated	Well Separated	Isolated Single	Isolated Clumps
(Crown Diameters Apart)	<0	0.0.25	0.25–1.0	1–20	>20	>20
Percentage Foliage Cover	>75	50–75	25–50	0.25–25	<0.25	<0.25
(T) Trees						
Over 35m	ETCF	ETOF	ETW	ETOW	ETIT	ETICT
20–35m	VTCF	VTOF	VTW	VTOW	VTIT	VTICT
12–20m	TCF	TOF	TW	TOW	TIT	TICT
6–12m	MHCF	MHOF	MHW	MHOW	MHIT	MHICT
3–6m	LCF	LOF	LW	LOW	LIT	LICT
1–3m	DCF	DOF	DW	DOW	DIT	DICT
(S) Shrubs						
6–12m	ETCS	ETS	ETOS	ETSS	ETIS	ETICS
3–6m	VTCS	VTS	VTOS	VTSS	VTIS	VTICS
1–3m	TCS	TS	TOS	TSS	TIS	TICS
0.5–1m	MHCS	MHS	MHOS	MHSS	MHIS	MHICS
0.26–0.5m	LCS	LS	LOS	LSS	LIS	LICS
Under 0.25m	DCS	DS	DOS	DSS	DIS	DICS
(G) Grass						
3–6m	ETCG	ETG	ETOG	ETSG	ETIG	ETICG
1–3m	VTCG	VTG	VTOG	VTSG	VTIG	TICG
0.5–1m	TCG	TG	TOG	TSG	TIG	VTICG
0.26–0.5m	MHCG	MHG	MHOG	MHSG	MHIG	MHICG
Under 0.25m	LCG	LG	LOG	LSG	LIG	LICG

Abbreviations Used

Height

ET – Extremely Tall
VT – Very Tall
T – Tall
MH – Mid-High
L – Low

Densities

CF – Closed Forest
OF – Open Forest
W – Woodland
OW – Open Woodland
IT – Isolated Clumps of Trees
CS – Closed Shrubland
S – Shrubland
OS – Open Shrubland
SS – Sparse Shrubland
IS – Isolated Shrubs
ICS – Isolated Clumps of Shrubs
SG – Sparse grassland
IG – Isolated Grass Tussocks
ICG – Isolated Clumps of Grass Tussocks

APPENDIX G

Appendix G - Flora Species List, Merlin Poject

Family	Genera	Species	Common Name	Status	Mine	1	2	3	4	5	6	7	8	9	10	11	12	13	Smith (1996)
Acanthaceae	Dicliptera	arnhemica		Endemic	x									x					x
Aizoaceae	Trianthema	rhynchocalyptra			x												x		x
Amaranthaceae	Achyranthes	aspera	Farmers Friend	Introduced			x	x	x				x						
Amaranthaceae	Alternanthera	denticulata	Lesser Joyweed		x														x
Amaranthaceae	Gomphrena	brachystylis			x												x	x	x
Amaranthaceae	Gomphrena	flaccida	Gomphrena Weed																x
Amaranthaceae	Ptilotus	fusiformis			x						x								x
Anacardiaceae	Buchanania	obovata	Green Plum		x										x				x
Asclepidaceae	Sarcostemma	viminale	Caustic Vine		x									x			x		x
Asteraceae	Bidens	bipinnata	Cobblers Pegs	Introduced		x	x	x					x			x			
Asteraceae	Blumea	saxatillis			x												x		x
Asteraceae	Pterocaulon	serrulatum			x												x		x
Asteraceae	Pterocaulon	sphacelatum	Apple Bush		x									x			x		x
Asteraceae	Xanthium	strumarium	Noogoora Burr	Introduced		x	x	x	x										
Bixiaceae	Chochlospermum	fraseri	Kapok Bush	Endemic				x			x			x					
Bixiaceae	Chochlospermum	gregorii	Kapok		x									x			x		x
Boraginaceae	Heliotropium	sp. NMS 3771																	x
Boraginaceae	Heliotropium	sp. NMS 3772																	x
Boraginaceae	Trichodesma	zeylanicum	Cattle Bush	Introduced	x												x	x	x
Caesalpiniaceae	Chamaecrista	symonii																	x
Caesalpiniaceae	Erythrophleum	chlorostachys	Cooktown Ironwood		x	x		x	x	x	x			x	x	x	x	x	x
Caesalpiniaceae	Lysiphyllum	cunninghamii	Bauhinia			x	x	x	x	x	x	x	x	x					x
Caesalpiniaceae	Senna	notabilis		Introduced		x		x					x						
Caesalpiniaceae	Senna	venusta			x												x		x
Capparaceae	Cleome	cleomoides			x	x			x					x			x		x
Capparaceae	Cleome	viscosa	Tickweed		x			x	x				x			x	x		x
Caryophyllaceae	Polycarpaea	corymbosa			x									x					x
Caryophyllaceae	Polycarpaea	multicaulis			x									x					x
Caryophyllaceae	Polycarpaea	spirostylis			x									x					x
Casuarinaceae	Casuarina	cunninghamiana	River Sheoak				x												
Combretaceae	Terminalia	bursarina							x										
Combretaceae	Terminalia	canescens			x	x	x	x	x	x	x	x	x	x					x
Combretaceae	Terminalia	carpentariae					x									x			
Combretaceae	Terminalia	platyphylla					x									x			
Combretaceae	Terminalia	volucris				x	x												
Commelinaceae	Cartonema	parviflorum			x													x	x
Commelinaceae	Commelina	ensifolia													x	x			x
Commelinaceae	Murdannia	graminea	Blue Murdannia		x													x	x
Convolvulaceae	Bonamia	pannosa			x			x		x			x				x	x	x
Convolvulaceae	Evolvulus	alsinoides	Blue periwinkle					x		x	x	x							
Convolvulaceae	Impomoea	nil			x								x				x		x
Convolvulaceae	Merremia	sp. NMS 3773																	x
Convolvulaceae	Polymeria	ambigua			x			x	x	x		x	x				x	x	x
Cucurbitaceae	Citrillus	lanatus	Wild Melon		x													x	x
Cucurbitaceae	Momordica	balsamina	Balsam Apple		x									x	x				x
Cyperaceae	Bulbostylis	barbata			x		x			x			x				x	x	x
Cyperaceae	Cyperus	carinatus																	x

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Family	Genera	Species	Common Name	Status	Mine	1	2	3	4	5	6	7	8	9	10	11	12	13	Smith (1996)
Cyperaceae	Cyperus	cunninghamii			x									x		x	x		x
Cyperaceae	Cyperus	exaltatus	Giant Sedge		x									x					x
Cyperaceae	Cyperus	holoschoenus			x													x	x
Cyperaceae	Cyperus	nervulosus			x										x				x
Cyperaceae	Cyperus	sp. NMS 3774																	x
Cyperaceae	Frimbristylis	acicularis			x											x		x	x
Cyperaceae	Frimbristylis	acuminata			x									x					x
Cyperaceae	Frimbristylis	miliacea		Uncertain															x
Cyperaceae	Frimbristylis	rara			x													x	x
Cyperaceae	Frimbristylis	sp. NMS 3775																	x
Cyperaceae	Frimbristylis	sp. NMS 3776																	x
Cyperaceae	Frimbristylis	sp. NMS 3777																	x
Cyperaceae	Frimbristylis	sphaeocephala																	x
Cyperaceae	Frimbristylis	squarrulosa			x				x	x				x			x	x	x
Cyperaceae	Frimbristylis	tetragona			x										x			x	x
Cyperaceae	Fuirena	ciliaris													x				x
Cyperaceae	Rhynchospora	longisetis			x										x			x	x
Cyperaceae	Rhynchospora	sp. NMS 3778																	x
Cyperaceae	Scleria	rugosa			x													x	x
Cyperaceae	Scleria	sp. NMS 3779																	x
Cyperaceae	Scleria	sp. NMS 3780																	x
Dilleniaceae	Hibbertia	lepidota			x									x			x	x	
Dilleniaceae	Hibbertia	sp. NMS 3782																	x
Droseraceae	Drosera	indica	Indian Sundew		x					x								x	x
Droseraceae	Drosera	petiolaris	Woolly Sundew		x					x				x	x			x	x
Ebenaceae	Diospyros	humilis	Native Ebony		x									x	x				
Euphorbiaceae	Antidesma	ghesaembilla							x										
Euphorbiaceae	Antidesma	parvifolium			x									x	x				x
Euphorbiaceae	Breynia	cernua	Coffee Bush		x										x	x		x	x
Euphorbiaceae	Briedelia	tomentosa			x										x				x
Euphorbiaceae	Euphorbia	hirta	Asthma Plant	Introduced		x	x						x						x
Euphorbiaceae	Euphorbia	tannensis	Desert Spurge		x														x
Euphorbiaceae	Euphorbia	vachelli			x														x
Euphorbiaceae	Euphorbia	sp. NMS 3785																	x
Euphorbiaceae	Excoecaria	parvifolia	Gutta Percha			x	x	x		x									
Euphorbiaceae	Flueggea	virosa	White Currant		x		x	x	x	x		x			x	x		x	x
Euphorbiaceae	Glochidion	xerocarpum	Buttonwood		x										x				x
Euphorbiaceae	Macaranga	tanarius	Macaranga		x	x									x				x
Euphorbiaceae	Petalostigma	pubescens	Quinine Tree			x		x	x	x									
Euphorbiaceae	Petalostigma	quadriloculare	Quinine Bush		x			x				x		x			x	x	x
Euphorbiaceae	Phyllanthus	sp. a.			x												x		x
Euphorbiaceae	Phyllanthus	sp. NMS 3782																	
Euphorbiaceae	Sauropus	sp. a.			x													x	
Euphorbiaceae	Sauropus	sp. NMS 3783																	x
Euphorbiaceae	Sauropus	sp. NMS 3784																	x
Fabaceae	Abrus	precatorius	Crab's-eye		x		x		x	x				x	x			x	x
Fabaceae	Aeschynomene	indica	Budda Pea		x										x				x

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Fabaceae	Bossiaea	bossiaeoides	Bossiaea		x					x				x			x	x	x
Fabaceae	Crotalaria	medicaginea	Trefoil Rattlepod		x			x				x	x						x
Fabaceae	Crotalaria	novae-hollandae				x		x			x		x						x
Fabaceae	Crotalaria	sp. NMS 3786																	x
Fabaceae	Desmodium	filiforme			x												x		x
Fabaceae	Desmodium	trichostachyum			x												x		x
Fabaceae	Glycine	sp. NMS 3787																	x
Fabaceae	Gompholobium	subulatum			x													x	x
Fabaceae	Indigofera	haplophylla			x									x					x
Fabaceae	Indigofera	hirsuta	Hairy Indigo		x									x			x		x
Fabaceae	Jacksonia	dilatata	Cladode Pea		x												x	x	x
Fabaceae	Jacksonia	odontoclada			x							x		x			x	x	x
Fabaceae	Sesbania	bentharniana	Sesbania Pea		x														x
Fabaceae	Stylosanthes	hamata	Stylo		x			x				x	x				x		
Fabaceae	Templetonia	hookeri	Templetonia		x			x		x		x						x	x
Fabaceae	Tephrosia	A26284 "McArthur River"																	x
Fabaceae	Tephrosia	brachydon			x									x			x		x
Fabaceae	Tephrosia	delestangii			x									x					
Fabaceae	Tephrosia	flammea								x									
Fabaceae	Tephrosia	phaeosperma			x									x					x
Fabaceae	Tephrosia	rosea	Flinder's River Poison		x									x			x		x
Fabaceae	Tephrosia	simplicifolia			x												x		x
Fabaceae	Tephrosia	spechtii			x									x					x
Fabaceae	Vigna	lanceolata					x	x	x	x						x			
Fabaceae	Zornia	muelleriana			x													x	x
Fabaceae	Zornia	nervata			x			x		x		x	x				x	x	
Flagellariaceae	Flagellaria	indica	Water Vine													x			x
Goodeniaceae	Goodenia	redacta			x													x	x
Goodeniaceae	Goodenia	sp. NMS 3788																	x
Goodeniaceae	Lechenaultia	filiformis			x									x			x		x
Goodeniaceae	Scaevola	revoluta																	x
Haemodoraceae	Haemodorum	brevicaule												x					x
Haemodoraceae	Haemodorum	coccineum	Blood Root		x							x					x		x
Halagoraceae	Gonocarpus	leptothecus			x													x	x
Hemionitidaceae	Platyzoma	microphyllum			x									x			x	x	x
Hernandiaceae	Gyrocarpus	americanis	Shitwood					x		x									
Lamiaceae	Anisomeles	malabarica			x									x					x
Lamiaceae	Hyptis	suaveolens	Hyptis				x		x							x			x
Lauraceae	Cassytha	filiformis	Dodder Laurel		x	x		x		x	x	x	x	x	x		x	x	x
Lecythidaceae	Barringtonia	acutangula	Freshwater Mangrove				x												
Lecythidaceae	Planchonia	careya	Cocky Apple			x	x	x	x	x				x		x			
Liliaceae	Crinium	angustifolium	Onion Lilly		x										x				x
Liliaceae	Iphigenia	indica			x												x		x
Loganiaceae	Mitrasacme	connata			x									x	x				x
Loranthaceae	Amyema	bifurcata			x												x		x
Loranthaceae	Lysiana	spathulata			x												x		x
Malvaceae	Abelmoschus	moschatus	Native Rosella			x		x		x									

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Malvaceae	Gossypium	australe	Native Cotton			x				x									
Malvaceae	Hibiscus	leptocladus			x			x		x				x			x	x	x
Malvaceae	Hibiscus	setulosis															x		x
Malvaceae	Hibiscus	sturtii		Rare	x									x					
Malvaceae	Hibiscus	zonatus		Endemic				x									x		x
Malvaceae	Sida	cordifolia	Flannel Weed	Introduced	x	x	x	x	x	x	x		x				x	x	
Malvaceae	Sida	macropoda			x						x							x	
Malvaceae	Sida	rhombifolia	Flannel Weed	Introduced	x	x	x	x	x	x			x				x	x	
Malvaceae	Sida	sp. NMS 3789																	x
Malvaceae	Sida	subspicata									x		x				x	x	
Malvaceae	Sida	virgata			x			x			x		x				x		
Meliaceae	Owenia	vernicosa	Emu Apple		x			x			x			x			x		x
Menispermaceae	Tinospora	smilacina	Snake Vine		x				x			x			x				x
Mimosaceae	Acacia	alleniana			x							x		x			x	x	x
Mimosaceae	Acacia	chippendalei			x							x					x		x
Mimosaceae	Acacia	dimidiata			x							x					x	x	x
Mimosaceae	Acacia	drepanocarpa			x							x					x	x	x
Mimosaceae	Acacia	dunnii	Elephants Ear Wattle		x							x		x			x	x	
Mimosaceae	Acacia	galioides		Endemic	x							x		x			x		
Mimosaceae	Acacia	gonocarpa			x							x							x
Mimosaceae	Acacia	hammondii			x							x		x			x	x	x
Mimosaceae	Acacia	holosericea	Candelabra Wattle		x							x		x			x	x	x
Mimosaceae	Acacia	latifolia			x							x							x
Mimosaceae	Acacia	mallocłada			x							x							x
Mimosaceae	Acacia	orthocarpa						x				x							
Mimosaceae	Acacia	platycarpa										x							x
Mimosaceae	Acacia	plectocarpa			x							x							x
Mimosaceae	Acacia	stipuligera			x							x							x
Mimosaceae	Acacia	torulosa			x							x					x		x
Mimosaceae	Acacia (affin.)	gonocarpa										x							
Mimosaceae	Acacia (affin.)	mallocłada										x							
Mimosaceae	Leucaena	leucocephala	Leucaena	Introduced		x	x												x
Mimosaceae	Neptunia	monosperma	Native Sensitive Plant			x													x
Moraceae	Ficus	coronulata	Creek Fig				x		x							x			
Moraceae	Ficus	leucotricha	Rock Fig								x				x	x			x
Moraceae	Ficus	opposita	Sandpaper Fig												x			x	x
Moraceae	Ficus	virens	Banyan												x				x
Myrtaceae	Asteromyrtus	symphyocarpa	Liniment Tree		x													x	x
Myrtaceae	Calytrix	achaeta									x								
Myrtaceae	Calytrix	exstipulata	Turkey Bush		x							x		x	x		x	x	x
Myrtaceae	Corymbia	aspera	Rough Leaved Ghost Gum		x			x			x	x		x			x		x
Myrtaceae	Corymbia	confertiflora	Broad Leaved Carbeen				x	x	x	x									
Myrtaceae	Corymbia	dichromophloia	Small Fruited Bloodwood		x			x		x	x	x		x			x	x	x
Myrtaceae	Corymbia	ferruginea	Rusty Bloodwood		x												x	x	x
Myrtaceae	Corymbia	grandifolia	Large Leaved Cabbage Gum			x	x	x	x	x			x			x			
Myrtaceae	Corymbia	ptychocarpa	Swamp Bloodwood		x													x	x
Myrtaceae	Corymbia	setosa	Rough Leaved Bloodwood		x													x	x

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Myrtaceae	Corymbia	terminalis	Desert Bloodwood			x		x	x	x	x	x	x						
Myrtaceae	Eucalyptus	camaldulensis	River Red Gum		x		x		x	x						x			
Myrtaceae	Eucalyptus	herbertiana	Kalumburu Gum		x			x			x	x	x	x	x		x		x
Myrtaceae	Eucalyptus	microtheca	Coolibah		x	x	x	x	x	x									
Myrtaceae	Eucalyptus	miniata	Darwin Woollybutt		x			x		x	x	x		x			x	x	x
Myrtaceae	Eucalyptus	papuana	Ghost Gum		x	x	x	x	x	x	x	x							
Myrtaceae	Eucalyptus	tectifica	Darwin Box			x		x	x	x	x	x	x						
Myrtaceae	Eucalyptus	tetradonta	Darwin Stringybark		x												x		x
Myrtaceae	Lophostemon	grandiflorus	Swamp Mahogany			x			x										
Myrtaceae	Melaleuca	argentea	Silver Leaved Ti-tree				x		x							x			
Myrtaceae	Melaleuca	leucadendra	Long Leaved Ti-tree				x		x							x			
Myrtaceae	Melaleuca	nervosa			x	x	x	x	x	x						x	x	x	x
Myrtaceae	Melaleuca	stenostachya																	
Myrtaceae	Melaleuca	viridiflora	Broad Leaved Ti-tree		x	x	x	x	x	x		x					x	x	x
Myrtaceae	Myrtella	A67473 "Cox River"																	x
Myrtaceae	Myrtella	retusa			x									x					
Myrtaceae	Syzygium	eucalyptoides							x							x			
Myrtaceae	Verticordia	cunninghamii	Cunninghams Feather Flower		x				x	x						x			x
Myrtaceae	Xanthostemon	paradoxus							x										
Nymphaceae	Nymphaea	violacea	Water Lilly		x										x				x
Onagraceae	Ludwigia	hyssopifolia			x				x						x			x	x
Onagraceae	Ludwigia	perennis			x													x	x
Opiliaceae	Opilia	amentacea			x										x				x
Orchidaceae	Cymbidium	canaliculatum					x		x	x					x				
Pandanaceae	Pandanus	aquaticus	Creek Pandanus																
Pandanaceae	Pandanus	spiralis	Screw Pine													x		x	x
Passifloraceae	Passiflora	foetida	Stinking Passionfruit	Introduced			x		x							x			x
Poaceae	Aristida	holathera	Erect Kerosene Grass		x												x	x	x
Poaceae	Cenchrus	echinatus	Mossman River Grass	Introduced	x												x		x
Poaceae	Chloris	inflata	Purple Topped Rhodes Grass	Introduced	x												x	x	x
Poaceae	Chyrsopogon	fallax				x	x	x			x								
Poaceae	Chyrsopogon	pallidus	Ribbon Grass		x			x			x					x		x	x
Poaceae	Cymbopogon	bombycinus	Silky Oilgrass		x									x					x
Poaceae	Cymbopogon	procerus	Lemon Grass		x									x					x
Poaceae	Dactyloctenium	radulans	Button Grass		x												x		x
Poaceae	Digitaria	bicornis	Hairy Finger Grass	Introduced	x					x		x	x			x	x	x	x
Poaceae	Echinochloa	colona	Awnless Barnyard Grass	Introduced		x	x												x
Poaceae	Ectrosia	leporina							x				x					x	
Poaceae	Ectrosia	schultzii	Hares Foot Grass		x													x	x
Poaceae	Elytrophorus	spicatus			x										x				x
Poaceae	Enneapogon	pallidus	Conetop Nineawn		x												x	x	x
Poaceae	Eragrostris	cumingii	Cumming's Lovegrass		x												x	x	x
Poaceae	Eriachne	ciliata	Slender Wanderrie Grass		x		x	x		x							x	x	x
Poaceae	Eriachne	melicae	Wanderrie Grass																x
Poaceae	Eriachne	obtusa	Northern Wanderrie Grass		x												x	x	x
Poaceae	Eriachne	triseta			x													x	
Poaceae	Eulalia	aurea	Silky Browntop		x				x	x				x					x

Appendix G - Flora Species List, Merlin Poject

Family	Genera	Species	Common Name	Status	Mine	1	2	3	4	5	6	7	8	9	10	11	12	13	Smith (1996)
Poaceae	Germainia	grandiflora			x										x				x
Poaceae	Germainia	truncatiglumis																	x
Poaceae	Heterachne	gulliveri			x													x	x
Poaceae	Heteropogon	contortus	Bunch Speargrass		x	x	x	x	x	x	x	x		x					x
Poaceae	Mnesithea	rottboellioides	Northern Canegrass		x									x					x
Poaceae	Ophiuros	exaltatus	Cane Grass											x					x
Poaceae	Panicum	mindanaense					x	x		x									x
Poaceae	Pennisetum	pedicellatum	Annual Pennisetum	Introduced	x			x					x				x		x
Poaceae	Perotis	rara	Comet Grass		x			x					x	x				x	x
Poaceae	Plectrachne	pungens	Soft Spinifex		x			x		x	x	x		x	x		x	x	x
Poaceae	Schizachyrium	fragile	Red Spathe Grass		x			x						x			x	x	x
Poaceae	Setaria	apiculata	Pidgeon Grass		x												x	x	x
Poaceae	Sorghum	sp. NMS 3790																	x
Poaceae	Sorghum	timorense			x		x	x	x	x								x	x
Poaceae	Sporobolus	pulchellus			x		x							x	x	x			x
Poaceae	Themeda	avenacea	Native Oatgrass					x		x									x
Poaceae	Vetiveria	elongata					x		x							x			x
Poaceae	Yakirra	australiensis	Bush Panic		x									x	x		x	x	x
Polygalaceae	Polygala	longifolia			x									x					
Polygalaceae	Polygala	sp. NMS 3791																	x
Portulacaceae	Calandrinia	quadrivalvis			x													x	x
Portulacaceae	Portulacca	bicolor	Heart Plant		x			x		x							x	x	x
Portulacaceae	Portulacca	pilosa			x												x		x
Proteaceae	Banksia	dentata	Tropical Banksia						x	x									x
Proteaceae	Grevillea	dimidiata	Caustic Bush				x				x								
Proteaceae	Grevillea	dryandri	Dryander's Grevillea	Endemic	x			x			x			x			x		x
Proteaceae	Grevillea	heliosperma	Rock Grevillea		x						x			x			x		x
Proteaceae	Grevillea	pteridifolia	Silver Leaf Grevillea		x			x		x				x			x	x	x
Proteaceae	Grevillea	refracta	Fern Leaf Grevillea		x			x		x				x			x	x	x
Proteaceae	Grevillea	wickhamii			x												x		x
Proteaceae	Hakea	arborescens	Hakea		x			x		x							x	x	x
Proteaceae	Persoonia	falcata	Milky Plum		x			x		x	x			x			x	x	x
Proteaceae	Stenocarpus	acacioides			x			x		x	x			x			x	x	x
Rhamnaceae	Alphitonia	excelsa	Soap Tree		x									x	x				x
Rhamnaceae	Ventilago	viminalis	Supplejack			x	x	x		x									
Rubiaceae	Gardenia	sp. a								x									
Rubiaceae	Gardenia	sp. NMS 3793																	x
Rubiaceae	Gardenia	sp.b													x				
Rubiaceae	Nauclea	orientalis	Leichardt Pine				x												
Rubiaceae	Oldenlandia	galioides			x												x		x
Rubiaceae	Pavetta	brownii			x					x				x	x				x
Rubiaceae	Spermacoce	brachystema			x									x			x	x	
Rubiaceae	Spermacoce	breviflora			x									x			x	x	
Rubiaceae	Spermacoce	sp. NMS 3793																	x
Rubiaceae	Spermacoce	sp. NMS 3794																	x
Rutaceae	Boronia	affinus			x							x		x					x
Rutaceae	Boronia	lanceolata			x							x		x				x	x

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Rutaceae	Boronia	lanuginosa			x							x		x				x	
Santalaceae	Exocarpus	latifolius	Broad Leaved Cherry		x												x		x
Santalaceae	Santalum	lanceolatum	Sandalwood			x		x		x									x
Sapindaceae	Atalaya	hemiglauca	Whitewood			x	x	x	x		x								
Sapindaceae	Cupaniopsis	anacardioides					x									x			
Sapindaceae	Distichostemon	hispidulus			x							x		x			x	x	x
Sapindaceae	Dodonaea	oxyptera				x		x											
Sapindaceae	Dodonaea	physocarpa					x	x		x									
Sapindaceae	Dodonaea	platyptera					x												
Sapotaceae	Pouteria	sericea			x				x					x	x				x
Scrophulariaceae	Adenosma	muelleri			x									x	x				x
Scrophulariaceae	Buchnera	linearis			x									x			x		x
Scrophulariaceae	Limnophila	fragrans												x	x				x
Scrophulariaceae	Stemodia	lythrifolia												x					
Sinopteridaceae	Cheilanthes	brownii			x									x				x	
Sinopteridaceae	Cheilanthes	seiberi			x									x			x	x	x
Sinopteridaceae	Cheilanthes	sp. NMS 3795																	x
Solanaceae	Solanum	diocium			x									x			x		x
Solanaceae	Solanum	sp. a						x								x			
Solanaceae	Solanum	sp. NMS 3796																	x
Stackhousiaceae	Stackhousia	intermedia			x													x	x
Sterculiaceae	Brachychiton	collinus	Sandstone Kurrajong								x			x	x				
Sterculiaceae	Brachychiton	diversifolius	Northern Kurrajong		x			x		x				x			x		x
Sterculiaceae	Brachychiton	paradoxus						x		x	x								
Sterculiaceae	Helicteres	isora				x			x	x									
Sterculiaceae	Melhania	oblongifolia				x													x
Stylidiaceae	Stylidium	sp. a	Trigger Plant																
Taccaceae	Tacca	leontopetaloides	Polynesian Arrowroot				x		x						x				x
Thymeliaceae	Thecanthes	sanguinea			x													x	x
Tiliaceae	Corchorus	sidoides			x		x				x			x					x
Tiliaceae	Grewia	retusifolia	Dogs Balls		x			x	x	x	x			x			x	x	x
Tiliaceae	Triumfetta	plumigera			x												x		x
Ulmaceae	Trema	tomentosa	Poison Peach		x									x	x				x
Verbenaceae	Clerodendrum	floribundum	Lolly Bush		x				x	x				x	x				x
Verbenaceae	Premna	acuminata			x				x						x	x			
Verbenaceae	Vitex	glabrata	Black Plum		x										x	x			x
Violocaeae	Hybanthus	enneaspermus	Spade Flower		x			x									x	x	
Vitaceae	Ampelocissus	acetosa	Wild Grape				x	x	x	x									
Vitaceae	Cayratia	trifolia	Native Grape		x				x	x									x
Xanthorrhoeaceae	Lomandra	multiflora			x			x		x							x	x	x
Xyridaceae	Xyris	complanata	Hatpins		x												x	x	x
Zygophyllaceae	Tribulopis	pentandra			x						x		x				x		x

APPENDIX H

TERRESTRIAL FAUNA OF THE MAIN MINE AREA

SC = Sandstone Scarp; CFW = *Corymbia ferruginea* Woodland; AHT = *Acacia hammondii* Thicket; Eucalyptus miniata Woodland
OW = Open Woodland
Gen = General site records, recorded while travelling between sites; AS = Air Strip; Mar = Escarp and creeks on site margins; Cam = Merlin Camp Area
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Common Name	Scientific Name	LATE WET SEASON (Smith 1996)									LATE DRY SEASON					
		SC	CFW	AHT	EMW	OW	Gen	AS	Mar	Camp	M1	M2	M3	M4	M5	Cam
AMPHIBIANS																
Family Myobatrachidae																
Ornate Burrowing Frog	*Limnodynastes ornatus*					2					X					
Froglet	*Crinia deserticola*											X				
Frog	*Uperoleia inundata*	1	1			1					X	X				
Frog	*Uperoleia lithomoda*											X				
Family Hylidae																
Tree Frog*	*Cyclorana australis*					1										
Green Tree Frog*	*Litoria caerulea*	6														
Saxicoline Tree Frog	*Litoria coplandi*											X				
Tree Frog	*Litoria meiriana*											X				
Brown Tree Frog	*Litoria rothii*									3						X
Tree Frog	*Litoria tornieri*			1								X				
Tree Frog	*Litoria wotjulumensis*				4							X				
Family Bufonidae																
Cane Toad	*Bufo marinus*	1	1	1	1	1				X		X				X
TOTAL AMPHIBIANS =	**12 species**	**3**	**2**	**2**	**2**	**4**	**0**	**0**	**1**	**2**	**2**	**8**	**0**	**0**	**0**	**2**
REPTILES																
Family Gekkonidae																
Clawless Gecko	*Crenadactylus ocellatus*												PF			
Spiny-tailed Gecko	*Diplodactylus ciliaris*														PF	
Northern Dtella	*Gehyra australis*	1									X					
Marbled Velvet Gecko	*Oedura marmorata*										SL	X				
Zig Zag Gecko	*Oedura rhombifer*												PF(4)		PF(3)	
Beaked Gecko*	*Rhynchoedura ornata*		1													
Family Pygopodidae																
Burton's Legless Lizard*	*Lialis burtonis*	1														
Family Agamidae																
Ring-tailed Dragon	*Ctenophorus caudicinctus*	5									X			X		
Dragon	*Diporiphora bennetii*											PF				

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Common Name	Scientific Name	SC	CFW	AHT	EMW	OW	Gen	AS	Mar	Camp	M1	M2	M3	M4	M5	Cam
Two-lined Dragon	*Diporiphora C.F. bilineata*					1						X		X		
Dragon	*Diporiphora magna*		1								PF(2)				X	
Gilbert's Dragon	*Lophognathus gilberti*															X
Family Varanidae																
Ridge-tailed Monitor	*Varanus storri*												ET			
Freckled Monitor	*Varanus tristis*												ET			
Family Scincidae																
Skink	*Carlia amax*										X	X				
Skink	*Carlia munda*										X	X			X	
Skink	*Cryptoblepharus plagiocephalus*										X	X				
Skink	*Ctenotus inornatus*	1												X		
Skink	*Ctenotus pantherinus*													X		
Skink	*Ctenotus pulchellus*	1									X				PF(3)	
Skink	*Ctenotus striaticeps*		1													
Skink	*Lerista orientalis*														X	
Fire-tailed Skink*	*Morethia ruficauda*	1														
Skink	*Proablepharus tenuis*	1									PF	PF				
Family Typhlopidae																
Blind Snake*	*Ramphotyphlops unguirostris*				1											
Family Boidae																
Children's Python	*Liasis childreni*											X				X
Olive Python	*Liasis olivaceus*											X				
Black-headed Python	*Aspidites melanocephalus*										SL		SL			
Family Elapidae																
Gwardar	*Pseudonaja nuchalis*		1													X
TOTAL REPTILES =	**29 species**	**7**	**4**	**0**	**1**	**1**	**0**	**0**	**0**	**0**	**10**	**9**	**5**	**4**	**6**	**3**
BIRDS																
Family Casuariidae																
Emu*	*Dromaius novaehollandiae*								X							
Family Phasianidae																
unidentified Quail														X		
Family Ardeidae																

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White-necked Heron	*Ardea pacifica*															
Family Accipitridae																
Black-breasted Buzzard	*Hamirostra melanosternon*			X												X
Black Kite	*Milvus migrans*									X			X		X	X
Brown Goshawk	*Accipiter fasciatus*															X
Wedge-tailed Eagle	*Aquila audax*															
Family Falconidae																
Australian Hobby*	*Falco longipennis*			X												
Nankeen Kestrel*	*Falco cenchroides*							X								
Family Otidae																
Australian Bustard	*Ardeotis australis*							X		X					X	X
Family Burhinidae																
Bush Stone-curlew	*Burhinus grallarius*										X			X		X
Family Charadriidae																
Masked Lapwing	*Vanellus miles*									X						X
Family Columbidae																
Common Bronzewing	*Phaps chalcoptera*							X			X	X				
Crested Pigeon	*Ochyphaps lophotes*		X											X		
Spinifex Pigeon	*Geophaps plumifera*									X	X	X		X	X	X
Diamond Dove	*Geopelia cuneata*			X		X										
Peaceful Dove	*Geopelia striata*								X			X	X	X		
Family Cacatuidae																
Red-tailed Black-Cockaloo	*Calyptorhynchus banksii*											X				
Sulphur-crested Cockaloo*	*Cacatua galerita*								X							
Cockatiel*	*Nymphicus hollandicus*						X									
Family Psittacidae																
Varied Lorikeet*	*Psitteuteles versicolor*	X		X	X											
Northern Rosella*	*Platycercus venustus*								X							
Budgerigar*	*Melopsittacus undulatus*															
Family Cuculidae																
Black-eared Cuckoo	*Chrysococcyx osculans*													X		
Channel-billed Cuckoo	*Scythrops novaehollandiae*												X			
Family Centropodidae																
Pheasant Coucal*	*Centropus phasianinus*								X							

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Family Strigidae																
Southern Boobook Owl	*Ninox novaeseelandiae*										SL		SL		SL	
Family Tytonidae																
Barn Owl	*Tyto alba*													SL		
Family Podargidae																
Tawny Frogmouth*	*Podargus strigoides*	X														
Family Caprimulgidae																
Spotted Nightjar*	*Eurostopodus argus*						X									
Family Aegothelidae																
Australian Owlet-nightjar*	*Aegotheles cristatus*						X									
Family Halcyonidae																
Red-backed Kingfisher	*Todiramphus pyrrhopygia*	X	X		X	X						X		X		
Family Meropidae											X					
Rainbow Bee-eater	*Merops ornatus*										X	X		X	X	
Family Coraciidae																
Dollarbird	*Eurystomus orientalis*										X					
Family Climacteridae																
Black-tailed Treecreeper	*Climacteris melanura*			X	X						X		X		X	
Family Maluridae																
Variegated Fairy-wren	*Malurus lamberti*			X							X	X				
Red-backed Fairy-wren	*Malurus melanocephalus*					X										X
Family Pardalotidae																
Striated Pardalote	*Pardolotus striatus*													X		
Weebill	*Smicrornis brevirostris*	X									X	X				
White-throated Gerygone	*Gerygone olivacea*								X					X		
Family Meliphagidae																
Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*			X												
Silver-crowned Friarbird	*Philemon argenticeps*	X	X	X	X	X					X	X	X		X	X
Little Friarbird	*Philemon citreogularis*			X	X	X								X		
Blue-faced Honeyeater	*Entomyzon cyanotis*			X										X		
Yellow-throated Miner	*Manorina flavigula*						X									
Singing Honeyeater	*Lichenostomus virescens*	X		X		X								X		
White-gaped Honeyeater	*Lichenostomus unicolor*								X		X	X	X		X	
Grey-fronted Honeyeater	*Lichenostomus plumulus*	X		X	X						X		X	X		

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Yellow-tinted Honeyeater	*Lichenostomus flavescens*								X		X					
White-throated Honeyeater	*Melithreptus albogularis*	X														
Brown Honeyeater	*Lichmera indistincta*	X		X	X	X										
Bar-breasted Honeyeater	*Ramsayornis fasciatus*								X		X					X
Rufous-throated Honeyeater	*Conopophila rufogularis*															
Banded Honeyeater	*Certhionyx pectoralis*															
Family Petroicidae																
Jacky Winter	*Microeca fascinans*		X			X					X		X	X		
Hooded Robin	*Melanodryas cucullata*													X		
Family Pomatostomidae																
Grey-crowned Babbler	*Pomatostomas temporalis*	X	X											X		
Family Neosittidae																
Varied Sittela	*Daphoenositta chrysoptera*	X	X	X		X								X		
Family Pachycephalidae																
Crested Bellbird	*Oreoicia gutturalis*							X								
Rufous Whistler	*Pachycephala rufiventris*	X		X							X			X		
Family Dicruridae																
Leaden Flycatcher*	*Myiagra rubecula*								X							
Australian Magpie-lark	*Grallina cyanoleuca*												X			X
Willie Wagtail	*Rhipidura leucophrys*		X			X								X		
Family Campephagidae																
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	X	X										X			X
White-bellied Cuckoo-shrike	*Coracina tenuirostris*								X		X		X	X		
White-winged Triller*	*Lalage sueurii*		X	X												
Family Artamidae																
Black-faced Woodswallow	*Artamus cinereus*			X	X						X		X	X	X	
Little Woodswallow	*Artamus minor*					X							X	X	X	
Pied Butcherbird	*Cracticus nigrogularis*												X		X	
Australian Magpie	*Gymnorhina tibicen*		X			X										X
Family Corvidae																
Torresian Crow	*Corvus orru*				X									X		X
Family Passeridae																
Double-barred Finch	*Taeniopygia bichenovii*								X							X
Long-tailed Finch	*Poephila acuticauda*									X	X	X				X

APPENDIX H
TERRESTRIAL FAUNA OF THE MAIN MINE AREA

SC = Sandstone Scarp; CFW = *Corymbia ferruginea* Woodland; AHT = *Acacia hammondii* Thicket; Eucalyptus miniata Woodland
OW = Open Woodland
Gen = General site records, recorded while travelling between sites; AS = Air Strip; Mar = Escarp and creeks on site margins; Cam = Merlin Camp Area
M1 = Late Dry Season Survey Mine Area Sample Site.
X=Present at site; SL = Spot Light; PF = Pitfall Trap; ET = Elliot Trap; SK = Skeletal Remains/Skin; HS = Hair Sample from Scat; TR = Tracks
UD = Ultra sonic Detection (ANABAT II Bat Detector); MN = Mist Net; HC = Hand Capture.
* = species recorded by Smith (1996) but not recorded during late dry season surveys

		LATE WET SEASON (Smith 1996)									LATE DRY SEASON					
Common Name	Scientific Name	SC	CFW	AHT	EMW	OW	Gen	AS	Mar	Camp	M1	M2	M3	M4	M5	Cam
Crimson Finch*	*Neochmia phaeton*								X							
Family Dicaeidae																
Mistletoebird*	*Dicaeum hirundinaceum*								X							
Family Sylviidae																
Rufous Songlark*	*Cincloramphus mathewsi*			X	X			X								
TOTAL BIRDS =	**75 species**	**13**	**10**	**18**	**10**	**12**	**4**	**5**	**14**	**5**	**20**	**11**	**15**	**25**	**11**	**16**
MAMMALS																
Family Dasyuridae																
Northern Dibbler	*Parantechinus bilarni*											HS				
Family Macropodidae																
Euro	*Macropus robustus*										X					
Agile Wallaby	*Macropus agilis*											HS				
Family Emballonuridae																
Common Sheathtail-bat	*Taphozous georgianus*										UD	UD/MN				
Family Molossidae																
Northern Freetail-bat	*Chaerephon jobensis*											UD				UD
Beccari's Freetail-bat	*Mormopterus beccarii*										UD					
Family Vespertilionidae																
Gould's Wattled Bat	*Chalinolobus gouldii*													UD		UD
Hoary Wattled Bat	*Chalinolobus nigrogriseus*														UD	
Little Broad-nosed Bat	*Scotorepens greyii*												UD			
Finlayson's Cave Bat	*Vespadelus finlaysoni*											MN				
Family Muridae																
Delicate Mouse	*Pseudomys delicatulus*														HC	
Common Rock-rat	*Zyzomys argurus*											HS				
Family Canidae																
Dingo	*Canis lupus dingo*										TR				X	X
Family Felidae																
Feral Cat	*Felis catus*											HS				
Family Equidae																
Donkey	*Equus asinus*														X	
Family Bovidae																

APPENDIX H
TERRESTRIAL FAUNA OF THE MAIN MINE AREA

SC = Sandstone Scarp; CFW = *Corymbia ferruginea* Woodland; AHT = *Acacia hammondii* Thicket; Eucalyptus miniata Woodland
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Gen = General site records, recorded while travelling between sites; AS = Air Strip; Mar = Escarp and creeks on site margins; Cam = Merlin Camp Area
M1 = Late Dry Season Survey Mine Area Sample Site.
X=Present at site; SL = Spot Light; PF = Pitfall Trap; ET = Elliot Trap; SK = Skeletal Remains/Skin; HS = Hair Sample from Scat; TR = Tracks
UD = Ultra sonic Detection (ANABAT II Bat Detector); MN = Mist Net; HC = Hand Capture.
* = species recorded by Smith (1996) but not recorded during late dry season surveys

		LATE WET SEASON (Smith 1996)									LATE DRY SEASON					
Common Name	Scientific Name	SC	CFW	AHT	EMW	OW	Gen	AS	Mar	Camp	M1	M2	M3	M4	M5	Cam
Cattle	*Bos taurus/Indicus*													X		X
TOTAL MAMMALS =	16 species	0	0	0	0	0	0	0	0	0	4	7	1	2	4	4

APPENDIX I

APPENDIX I
TERRESTRIAL FAUNA OF THE ROUTE CORRIDOR

X=Present at site; SL = Spot Light; SK = Skeletal Remains/Skin; HS = Hair Sample from Scat
UD = Ultra sonic Detection (ANABAT II Bat Detector); MN = Mist Net

Common Name	Scientific Name	LATE DRY SEASON SURVEY ROUTE CORRIDOR SITES (RS)																									
		RS 1	RS 2	RS 3	RS 4	RS 5	RS 6	RS 7	RS 8	RS 9	RS 10	RS 11	RS 12	RS 13	RS 14	RS 15	RS 16	RS 17	RS 18	RS 19	RS 20	RS 21	RS 22	RS 23	RS 24	RS 25	RS 26	RS 27
AMPHIBIANS																											
Family Myobatrachidae																											
Froglet	*Crinia deserticola*	X																									
Family Hylidae																											
Green Tree Frog	*Litoria caerulea*		X				X								X												
Brown Tree Frog	*Litoria rothii*							X								X											
Burrowing Frog	*Cyclorana australis*																									X		
Family Bufonidae																											
Cane Toad	*Bufo marinus*	PF																									X
TOTAL AMPHIBIANS =	**5 species**	2	1	0	0	0	1	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	1
REPTILES																											
Family Crocodylidae																											
Freshwater Crocodile	*Crocodylus johnstoni*	X																									X
Family Gekkonidae																											
Northern Diella	*Gehyra australis*		X	X			X								X												
Gecko	*Gehyra borroloola*									X																	
Zig Zag Gecko	*Oedura rhombifer*										X																
Family Pygopodidae																											
Burton's Legless Lizard	*Lialis burtonis*																X										
Family Agamidae																											
Frilled Lizard	*Chlamydosaurus kingii*																								X		
Ring-tailed Dragon	*Ctenophorus caudicinctus*					X		X	X																		
Two-lined Dragon	*Diporiphora bilineata*			X													X										

APPENDIX I
TERRESTRIAL FAUNA OF THE ROUTE CORRIDOR

X=Present at site; SL = Spot Light; SK = Skeletal Remains/Skin; HS = Hair Sample from Scat
UD = Ultra sonic Detection (ANABAT II Bat Detector); MN = Mist Net

Common Name	Scientific Name	LATE DRY SEASON SURVEY ROUTE CORRIDOR SITES (RS)																										
		RS 1	RS 2	RS 3	RS 4	RS 5	RS 6	RS 7	RS 8	RS 9	RS 10	RS 11	RS 12	RS 13	RS 14	RS 15	RS 16	RS 17	RS 18	RS 19	RS 20	RS 21	RS 22	RS 23	RS 24	RS 25	RS 26	RS 27
Gilbert's Dragon	*Lophognathus gilberti*	X					X									X							X			X	X	X
Family Scincidae																												
Skink	*Carlia amax*				X																							
Skink	*Carlia munda*					X																						
Skink	*Cryptoblepharus plagiocephalus*					X	X												X									
Skink	*Cryptoblepharus megastictus*		X					X																				
Skink	*Ctenotus inornatus*						X		X										X									
Skink	*Ctenotus pulchellus*			X			X				X						X											
Fire-tailed Skink	*Morethia ruficauda*				X																							
Family Boidae																												
Children's Python	*Liasis childreni*																X											
Olive Python	*Liasis olivaceus*				SK																							
Family Elapidae																												
King Brown Snake	*Pseudechis australis*	X																										
TOTAL REPTILES =	19 species	3	2	3	3	3	5	2	2	1	2	0	0	0	1	1	4	0	2	0	0	0	1	0	1	1	1	2
BIRDS																												
Family Phasianidae																												
Brown Quail	*Coturnix ypsilophora*																	X					X					
Family Anhingidae																												
Darter	*Anhinga melanogaster*	X																										
Family Ardeidae																												
Little Egret	*Egretta garzetta*	X																										
Nankeen Night Heron	*Nycticorax caledonicus*	X																										

APPENDIX 1
TERRESTRIAL FAUNA OF THE ROUTE CORRIDOR

X=Present at site; SL = Spot Light; SK = Skeletal Remains/Skin; HS = Hair Sample from Scat
UD = Ultra sonic Detection (ANABAT II Bat Detector); MN = Mist Net

Common Name	Scientific Name	LATE DRY SEASON SURVEY ROUTE CORRIDOR SITES (RS)																										
		RS 1	RS 2	RS 3	RS 4	RS 5	RS 6	RS 7	RS 8	RS 9	RS 10	RS 11	RS 12	RS 13	RS 14	RS 15	RS 16	RS 17	RS 18	RS 19	RS 20	RS 21	RS 22	RS 23	RS 24	RS 25	RS 26	RS 27
Family Accipitridae																												
Black Kite	*Milvus migrans*	X													X										X	X	
Brown Goshawk	*Accipiter fasciatus*	X															X										
Family Falconidae																												
Brown Falcon	*Falco berigora*																						X	X			
Family Gruidae																												
Brolga	*Grus rubicunda*			X																							
Family Otidae																												
Australian Bustard	*Ardeotis australis*										X																
Family Charadriidae																												
Masked Lapwing	*Vanellus miles*	X																								X	
Family Columbidae																												
Common Bronzewing	*Phaps chalcoptera*		X	X							X																
Spinifex Pigeon	*Geophaps plumifera*							X	X		X		X		X												
Peaceful Dove	*Geopelia striata*				X	X				X						X		X	X			X				X	
Bar-shouldered Dove	*Geopelia humeralis*	X	X													X											
Family Cacatuidae																												
Red-tailed Black-Cockatoo	*Calyptorhynchus banksii*	X																									
Galah	*Cacatua roseicapilla*																					X					
Sulphur-crested Cockatoo	*Cacatua galerita*	X																									
Family Psittacidae																												
Varied Lorikeet	*Psitteuteles versicolor*																					X					
Red-winged Parrot	*Aprosmictus erythropterus*	X																									
Northern Rosella	*Platycerus venustus*	X				X																					
Family Cuculidae																												
Brush Cuckoo	*Cacomantis variolosus*	X				X									X												
Common Koel	*Eudynamys scolopacea*	X	X						X								X	X								X	

APPENDIX 1
TERRESTRIAL FAUNA OF THE ROUTE CORRIDOR

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Common Name	Scientific Name	LATE DRY SEASON SURVEY ROUTE CORRIDOR SITES (RS)																									
		RS 1	RS 2	RS 3	RS 4	RS 5	RS 6	RS 7	RS 8	RS 9	RS 10	RS 11	RS 12	RS 13	RS 14	RS 15	RS 16	RS 17	RS 18	RS 19	RS 20	RS 21	RS 22	RS 23	RS 24	RS 25	RS 26	RS 27
Channel-billed Cuckoo	*Scythrops novaehollandiae*		X						X																		
Family Centropodidae																											
Pheasant Coucal	*Centropus phasianinus*	X	X					X							X								X			X		
Family Strigidae																											
Barking Owl	*Ninox connivens*																										X
Family Caprimulgidae																											
Spotted Nightjar	*Eurostopodus argus*										X																
Family Halcyonidae																											
Blue-winged Kookaburra	*Dacelo leachii*		X					X								X										X	
Red-backed Kingfisher	*Todiramphus pyrrhopygia*		X		X							X				X	X		X	X	X					X	
Sacred Kingfisher	*Todiramphus sanctus*																									X		
Family Meropidae																											
Rainbow Bee-eater	*Merops ornatus*	X	X	X		X	X			X		X	X		X	X										X		
Family Coraciidae																											
Dollarbird	*Eurystomus orientalis*	X	X												X	X	X	X				X	X	X			X	
Family Climacteridae																											
Black-tailed Treecreeper	*Climacteris melanura*									X	X		X	X					X					X	X			
Family Maluridae																											
Variegated Fairy-wren	*Malurus lamberti*												X															X
Red-backed Fairy-wren	*Malurus melanocephalus*		X		X											X	X	X		X								
Family Pardalotidae																											
Striated Pardalote	*Pardolotus striatus*		X																								
Weebill	*Smicrornis brevirostris*		X		X				X					X		X			X								
Family Meliphagidae																											
Silver-crowned Friarbird	*Philemon argenticeps*			X										X		X		X	X							X	X	
Blue-faced Honeyeater	*Entomyzon cyanotis*	X																					X					
White-gaped Honeyeater	*Lichenostomus unicolor*	X					X		X				X								X							X

APPENDIX 1
TERRESTRIAL FAUNA OF THE ROUTE CORRIDOR

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Common Name	Scientific Name	LATE DRY SEASON SURVEY ROUTE CORRIDOR SITES (RS)																										
		RS 1	RS 2	RS 3	RS 4	RS 5	RS 6	RS 7	RS 8	RS 9	RS 10	RS 11	RS 12	RS 13	RS 14	RS 15	RS 16	RS 17	RS 18	RS 19	RS 20	RS 21	RS 22	RS 23	RS 24	RS 25	RS 26	RS 27
Grey-fronted Honeyeater	*Lichenostomus plumulus*					X					X																	
Yellow-tinted Honeyeater	*Lichenostomus flavescens*	X																					X					X
Brown Honeyeater	*Lichmera indistincta*																						X					X
Bar-breasted Honeyeater	*Ramsayornis fasciatus*																											X
Rufous-throated Honeyeater	*Conopophila rufogularis*	X								X						X			X	X	X	X		X				
Banded Honeyeater	*Certhionyx pectoralis*																						X					X
Family Petroicidae																												
Jacky Winter	*Microeca fascinans*										X							X			X							
Family Pomatostomidae																												
Grey-crowned Babbler	*Pomatostomas temporalis*	X	X	X		X										X					X			X		X		
Family Neosittidae																												
Varied Sittela	*Daphoenositta chrysoptera*																		X	X								
Family Pachycephalidae																												
Crested Bellbird	*Oreoicia gutturalis*									X																		
Rufous Whistler	*Pachycephala rufiventris*	X	X	X												X		X	X	X		X	X		X	X		X
Little Shrike-thrush	*Colluricincla megarhyncha*																											X
Sandstone Shrike-thrush	*Colluricincla woodwardi*						X								X													
Grey Shrike-thrush	*Colluricincla harmonica*									X										X								
Family Dicruridae																												
Leaden Flycatcher	*Myiagra rubecula*	X														X												
Restless Flycatcher	*Myiagra inquieta*	X																										
Australian Magpie-lark	*Grallina cyanoleuca*	X	X													X							X	X		X		
Willie Wagtail	*Rhipidura leucophrys*	X				X									X					X								
Family Campephagidae																												
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*					X					X					X	X											
White-bellied Cuckoo-shrike	*Coracina tenuirostris*		X	X				X				X		X		X				X								
White-winged Triller	*Lalage sueuril*									X										X		X						

APPENDIX 1
TERRESTRIAL FAUNA OF THE ROUTE CORRIDOR

X=Present at site; SL = Spot Light; SK = Skeletal Remains/Skin; HS = Hair Sample from Scat
UD = Ultra sonic Detection (ANABAT II Bat Detector); MN = Mist Net

Common Name	Scientific Name	LATE DRY SEASON SURVEY ROUTE CORRIDOR SITES (RS)																									
		RS 1	RS 2	RS 3	RS 4	RS 5	RS 6	RS 7	RS 8	RS 9	RS 10	RS 11	RS 12	RS 13	RS 14	RS 15	RS 16	RS 17	RS 18	RS 19	RS 20	RS 21	RS 22	RS 23	RS 24	RS 25	RS 26	RS 27
Family Oriolidae																											
Olive-backed Oriole	*Oriolus sagittatus*																	X									
Family Artamidae																											
Black-faced Woodswallow	*Artamus cinereus*			X						X	X	X						X	X				X	X			
Little Woodswallow	*Artamus minor*											X		X									X				
Pied Butcherbird	*Cracticus nigrogularis*		X	X					X			X				X	X	X		X	X					X	
Australian Magpie	*Gymnorhina tibicen*								X																		
Family Corvidae																											
Torresian Crow	*Corvus orru*					X	X						X	X		X		X									X
Family Ptilonorhynchidae																											
Great Bowerbird	*Chlamydera nuchalis*	X		X	X	X										X						X	X		X	X	X
Family Passeridae																											
Zebra Finch	*Taeniopygia guttata*																							X			
Double-barred Finch	*Taeniopygia bichenovii*	X	X	X	X					X	X			X					X	X		X	X	X			X
Long-tailed Finch	*Poephila acuticauda*			X						X										X	X						
Masked Finch	*Poephila personata*									X																	
Crimson Finch	*Neochmia phaeton*	X																									X
Star Finch	*Neochmia ruficauda*																							X			
Pictorella Mannikin	*Heteromunia pectoralis*																							X	X		
TOTAL BIRDS =	74 species	29	18	12	6	10	4	4	7	11	10	6	6	7	7	20	6	11	11	13	7	6	12	11	8	11	8	13
MAMMALS																											
Family Macropodidae																											
Euro	*Macropus robustus*					X		X	X	X		X															
Agile Wallaby	*Macropus agilis*														HS				X	X							

APPENDIX 1
TERRESTRIAL FAUNA OF THE ROUTE CORRIDOR

X=Present at site; SL = Spot Light; SK = Skeletal Remains/Skin; HS = Hair Sample from Scat
UD = Ultra sonic Detection (ANABAT II Bat Detector); MN = Mist Net

Common Name	Scientific Name	LATE DRY SEASON SURVEY ROUTE CORRIDOR SITES (RS)																										
		RS 1	RS 2	RS 3	RS 4	RS 5	RS 6	RS 7	RS 8	RS 9	RS 10	RS 11	RS 12	RS 13	RS 14	RS 15	RS 16	RS 17	RS 18	RS 19	RS 20	RS 21	RS 22	RS 23	RS 24	RS 25	RS 26	RS 27
Antilopine Wallaroo	*Macropus antelopinus*																								X		
Family Emballonuridae																											
Common Sheathtail-bat	*Taphozous georgianus*							MN		MN					MN												
Family Molossidae																											
Beccari's Freetail-bat	*Mormopterus beccarii*	UD							UD																		
Family Vespertilionidae																											
Gould's Wattled Bat	*Chalinolobus gouldii*	UD																									
Large-footed Myotis	*Myotis mollucarum*	UD																									
Little Broad-nosed Bat	*Scotorepens greyii*							UD																			
Finlayson's Cave Bat	*Vespadelus finlaysoni*														MN												
Family Canidae																											
Dingo	*Canis lupus dingo*		X							X	X				HS											X	
Family Equidae																											
Donkey	*Equus asinus*	X	X			X						X				X							X			X	X
Family Bovidae																											
Cattle	*Bos taurus/indicus*																										
																					X			X	X	X	X	X
TOTAL MAMMALS =	12 species	4	2	0	0	2	0	3	2	3	1	2	0	0	4	1	0	0	1	1	1	0	0	2	1	2	3	2

APPENDIX J

ABORIGINAL AREAS PROTECTION AUTHORITY

AUTHORITY CERTIFICATE

Issued in accordance with Section 22 of the Aboriginal Sacred Sites Act

REFERENCE: D89/199;90/1015 (Doc:22357) C97/ 037

Amendment to C97/037

APPLYING TO: Merlin Mine area as shown on the attached map.

PROPOSED WORK OR USE: The area will be subject to various activities relating to mining. This would include, but would not be restricted to the erection of plant and infrastructure, construction of a camp site, borefield, tailings and water storage facilities, construction of roads and all activities associated with mining and processing.

ISSUED TO: Ashton Mining Pty Ltd
21 Wynyard Street
BELMONT W.A. 2096

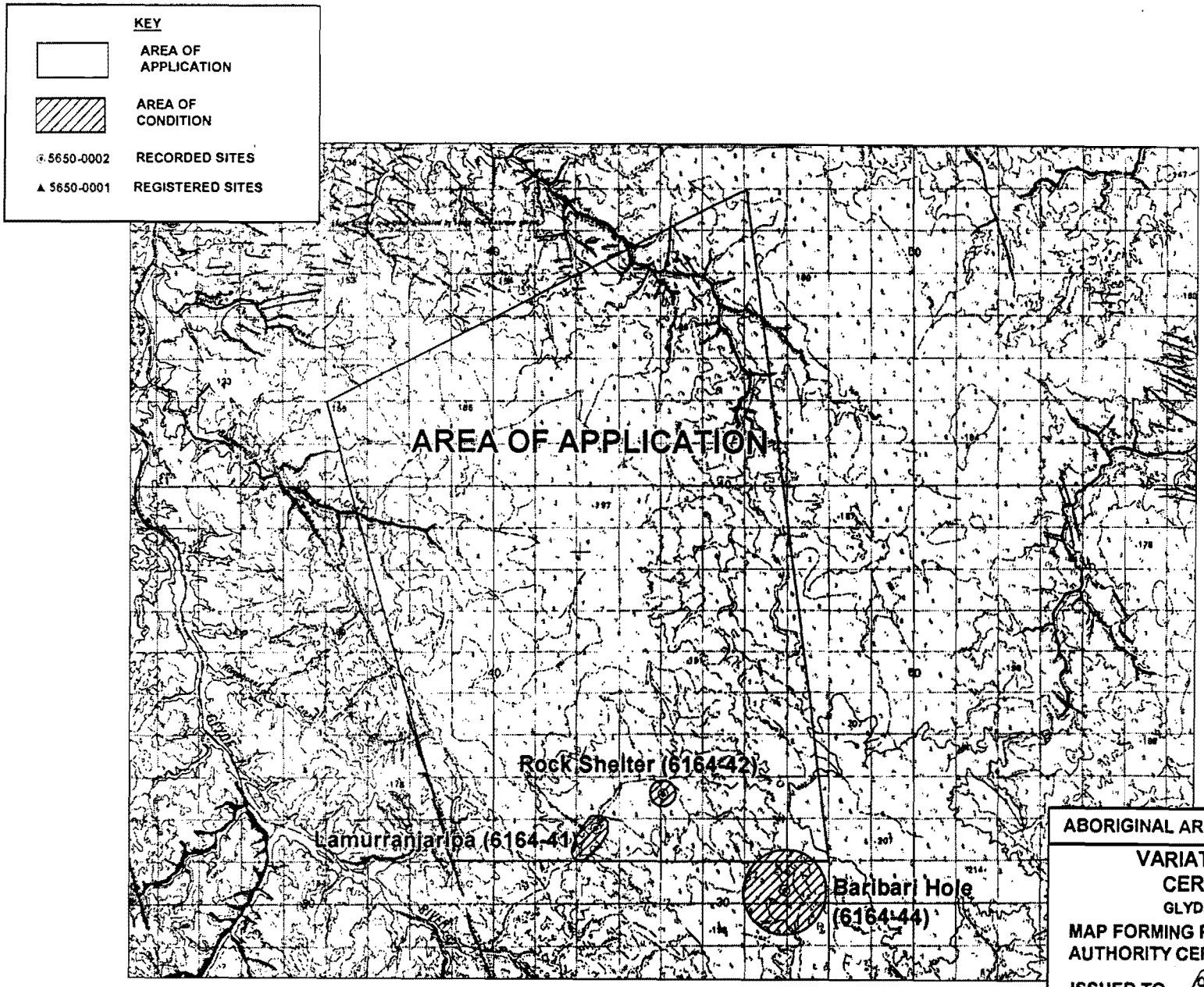
CONDITIONS:

1. It is the responsibility of the recipient of this Certificate to:
   (i) Include the conditions of this Certificate in any subsequent contract or tender document commissioning works described in this Certificate.
   (ii) Otherwise inform agents and employees of the conditions of this Certificate and obligations under the *Aboriginal Sacred Sites (NT) Act 1989.*
2. The proposed use or works covered by this Certificate must commence within 24 months of the date of issue.
3. The information on the map relate specifically to the areas of the Certificate as marked and the fact that sites are not shown in other areas should not be taken as a definitive indication of the existence or lack of existence of sites in these areas.
4. The map attached to the Certificate forms part of the Certificate.
5. There must be no entry to or works upon the three hatched areas labelled 6164-41, 6164-42 and 6164-44 as shown on the attached map.

The COMMON SEAL of the ABORIGINAL AREAS PROTECTION AUTHORITY was hereto affixed on the 18th day of March 1997

COMMON SEAL

DAVID RITCHIE
Chief Executive Officer



ABORIGINAL AREAS PROTECTION AUTHORITY

VARIATION TO AUTHORITY CERTIFICATE C94/001

GLYDE - 6164 - MAP SCALE 1:100000

MAP FORMING PART OF AUTHORITY CERTIFICATE C97/037

ISSUED TO Ashton Mining P/L

AUTHORISED COPY: NUMBER 1 OF 5

CHECKED BY: DATE 7.3.97

T.HOSIE - SENIOR LAND INFORMATION OFFICER J97-008

ABORIGINAL AREAS PROTECTION AUTHORITY

AUTHORITY CERTIFICATE

Issued in accordance with Section 22 of the Aboriginal Sacred Sites Act

REFERENCE: D89/199;90/1015 (Doc:17701) C96/030

APPLYING TO: A 2 kilometre wide corridor, centred on an existing access track between Carpentaria Highway and Boomerang Creek, Borroloola district. The corridor is highlighted in yellow on the attached map.

PROPOSED WORK OR USE: Construction of an all weather gravel access track.

ISSUED TO: Ashton Mining Limited
1st Floor, 24 Outram Street
WEST PERTH W.A. 6005

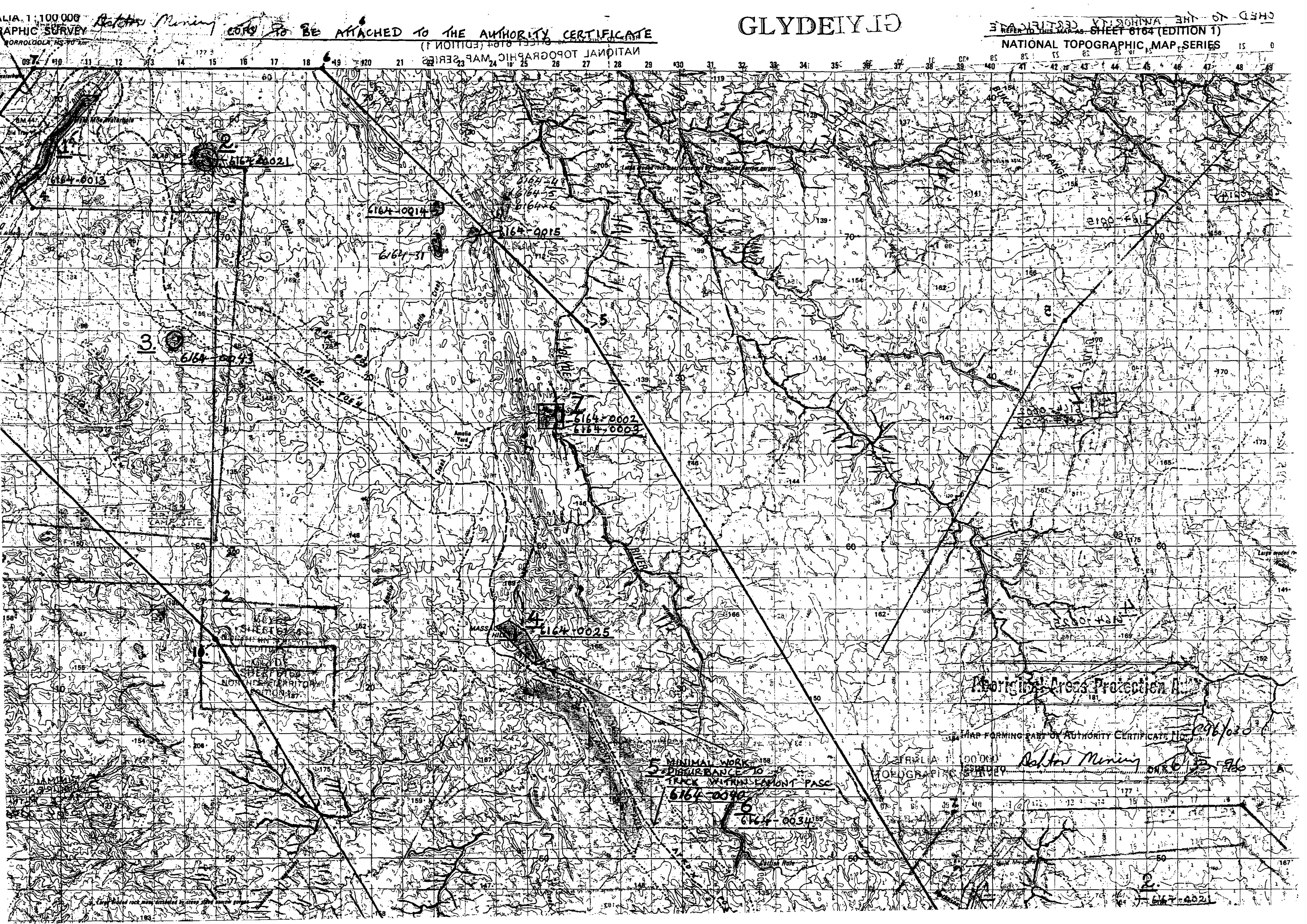
CONDITIONS:

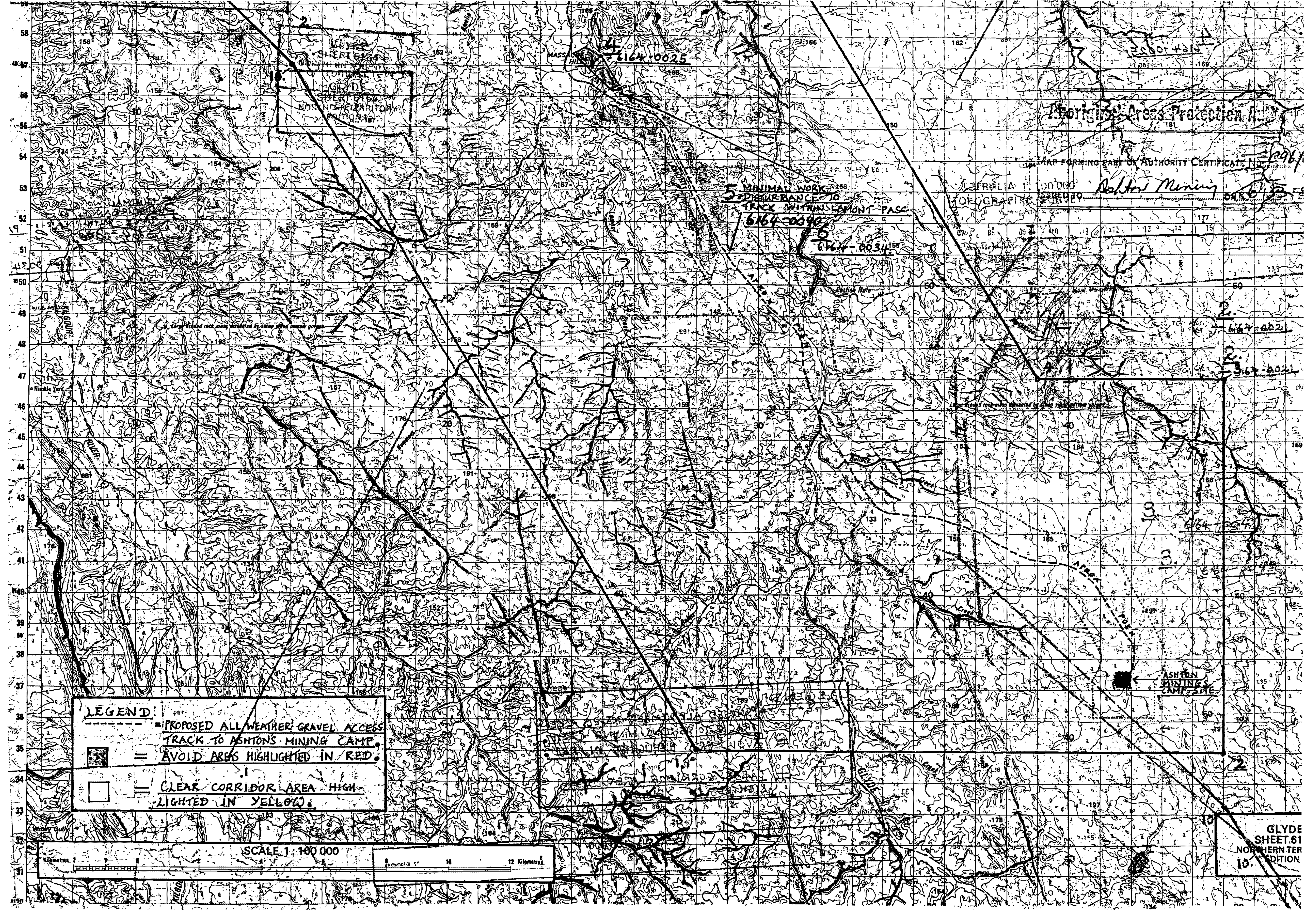
1. It is the responsibility of the recipient of this Certificate to:
   (i) Include the conditions of this Certificate in any subsequent contract or tender document commissioning works described in this Certificate.
   (ii) Otherwise inform agents and employees of the conditions of this Certificate and obligations under the *Aboriginal Sacred Sites (NT) Act 1989.*
2. The proposed use or works covered by this Certificate must commence within 24 months of the date of issue.
3. The information on the maps relate specifically to the areas of the Certificate as marked and the fact that sites are not shown in other areas should not be taken as a definitive indication of the existence or lack of existence of sites in these areas.
4. The map attached to the Certificate forms part of the Certificate.
5. No damage of the sacred sites highlighted in red on the map attached to the certificate.
6. Minimal disturbance to the existing track through Area 5 (Lamont Pass) as indicated on the map.

The COMMON SEAL of the
ABORIGINAL AREAS PROTECTION AUTHORITY
was hereto affixed on the 6th day of
March 1996

ABORIGINAL AREAS PROTECTION AUTHORITY
COMMON SEAL

DAVID RITCHIE
Chief Executive Officer


LIA 1:100 000
RAPHIC SURVEY
Ashton Mining
COPY TO BE ATTACHED TO THE AUTHORITY CERTIFICATE
GLYDE
REFER TO THIS MAP AS: SHEET 6164 (EDITION 1)
NATIONAL TOPOGRAPHIC MAP SERIES
1.
6164-0013
2.
6164-0021
6164-0014
6164-0015
6164-4
6164-5
6164-6
6164-31
3.
6164-0043
7.
6164-0002
6164-0003
4
6164-0025
Amelia Yard
RIVER
VALLEY
Creek
Mass Hill
Aboriginal Areas Protection Act
MAP FORMING PART OF AUTHORITY CERTIFICATE No. C96/030
Ashton Mining
5 MINIMAL WORK DISTURBANCE TO TRACK WITHIN LAMONT PASS
6164-0040
6
6164-0034
Catfish Hole
SHEET 6164
GLYDE
NORTHERN TERRITORY
EDITION 1
CAMP SITE
Large eroded rock mass dissected by steep sided narrow gorges
2.
6164-0021



LEGEND:
= PROPOSED ALL WEATHER GRAVEL ACCESS TRACK TO ASHTON'S MINING CAMP.
= AVOID AREAS HIGHLIGHTED IN RED.
= CLEAR CORRIDOR AREA HIGHLIGHTED IN YELLOW.
4 6164-0025
5 MINIMAL WORK DISTURBANCE TO TRACK WITHIN LAMONT PASS
6164-0040
6 6164-0034
MAP FORMING PART OF AUTHORITY CERTIFICATE No.
Ashton Mining
Catfish Hole
ASHTON MINING CAMP SITE
SCALE 1 : 100 000
GLYDE

APPENDIX K

National Trust
of Australia (Northern Territory)

NATIONAL TRUST

GPO Box 3520
Darwin
NT 0801

Telephone: (089) 81 2848
Facsimile: (089) 81 2379

Our Ref: 1/151

4 October 1995

Ms Donna Reynolds
Tenement Officer
Ashton Mining Ltd.
PO Box 962
WEST PERTH WA 6872

Dear Donna,

Re: SEL 8630 - Substantial Disturbance

Thank you for your correspondence of 3 October 1995 in which you advised of proposed substantial disturbance work at your SEL 8630. Thank you also for the detailed information you provided on the location of the proposed works.

A review of site files held by the National Trust (NT) indicates that there are no recorded sites of heritage significance on SEL 8630. However, we are aware that the area in which SEL 8630 is situated was an important part of the early pastoral endeavours in the Gulf Region of the NT and accordingly we would welcome any information that your contractors might provide should they locate any remains of these activities

Such relics would include former yards, homestead or camp sites and surface scatters of artefacts. We would be most appreciative of information on these sites in the form of position, sketch plans and photographs if possible. This would then provide us the opportunity to update our files, and importantly, increase our knowledge of the region.

I trust this information is of assistance to you and I look forward to hearing from you.

Yours sincerely,

Bob Alford
Director

AUSTRALIAN HERITAGE
COMMISSION

Reference: 95/495

30 August 1996

Ms Melanie Cox
Dames and Moore
PO Box 2005
DARWIN NT 0801

Dear Ms Cox

Thank you for your enquiry requesting a search of an area in the Northern Territory covered by Latitudes/Longitudes 16 degrees 45 minutes to 16 degrees 55 minutes and 136 degrees 15 minutes to 136 degrees 25 minutes.

Upon searching our Register Database and maps, no listings were found in this area.

If you require any further information, please don't hesitate to contact me on (06) 217 2153.

Yours sincerely

Richard Bray
Register of the National Estate Section

MTA HOUSE 39 BRISBANE AVENUE BARTON ACT 2600 PHONE (06) 217 2111 MTA FAX (06) 217 2095 IBM FAX (06) 217 2000
GPO BOX 1567 CANBERRA ACT 2601 AUSTRALIA

APPENDIX L

APPENDIX L

Suggested Species for Rehabilitation Purposes

Family	Species Name	Common Name
Bixiaceae	*Cochlospermum gregorii*	Kapok
Cyperaceae	*Fimbristylis squarrulosa*	a sedge
Dilleniaceae	*Hibbertia lepidota*	a hibbertia
Euphorbiaceae	*Petalostigma quadriloculare*	Quinine Bush
Fabaceae	*Bossiaea bossiaeoides*	Bossiaea Pea
Fabaceae	*Crotalaria medicaginea*	Trefoil Rattlepod
Fabaceae	*Jacksonia odontoclada*	Jacksonia Pea
Fabaceae	*Templetonia hookeri*	Templetonia Pea
Fabaceae	*Tephrosia* spp.	pea species
Malvaceae	*Hibiscus leptocladus*	Native Cotton
Mimosaceae	*Acacia alleniana*	a wattle
Mimosaceae	*Acacia dimidiata*	a wattle
Mimosaceae	*Acacia drepanocarpa*	a wattle
Mimosaceae	*Acacia gonocarpa*	a wattle
Mimosaceae	*Acacia hammondii*	a wattle
Mimosaceae	*Acacia holosericea*	Candelabra Wattle
Mimosaceae	*Acacia platycarpa*	a wattle
Mimosaceae	*Acacia malloclada*	a wattle
Myrtaceae	*Calytrix exstipulata*	Turkey Bush
Myrtaceae	*Corymbia dichromophloia*	Small-fruited Bloodwood
Myrtaceae	*Corymbia ferruginea*	Rusty Bloodwood
Myrtaceae	*Corymbia setosa*	Rough-leaved Bloodwood
Myrtaceae	*Eucalyptus herbertiana*	Kalamburu Gum
Myrtaceae	*Eucalyptus miniata*	Darwin Woollybutt
Poaceae	*Heteropogon contortis*	Bunch Speargrass
Poaceae	*Plectrachne pungens*	Soft Spinifex
Poaceae	*Sorghum timorensis*	Sorghum
Proteaceae	*Grevillea pteridifolia*	Fern-leaf Grevillea
Proteaceae	*Grevillea refracta*	Silver-leaf Grevillea
Rubiaceae	*Pavetta brownii*	a shrub
Rutaceae	*Boronia lanuginosa*	a boronia
Sapindaceae	*Distichostemon hispidulus*	a shrub