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ENVIRONMENTAL ISSUES REPORT
ML 2M/99 – GOLDEN TRIANGLE RES.
MAIN CK.MAGENSITE PROJECT

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Golden Triangle Resources NL

Main Creek Magnesite Project

Environmental Issues Report

August 1998
CR 872/1/v2

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AMG REFERENCE POINTS ADDED

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1. Introduction

1.1 Background

Golden Triangle Resources NL (GTR) is undertaking a scoping study to determine the technical feasibility and preliminary costs for the mining and processing of a magnesite deposit near Savage River, Tasmania (Figure 1.1). The project concept involves mining 250,000 to 400,000 tpa of high grade magnesite, beneficiation of the ore (if required), then transport to a hydrochloric acid-leach refinery (possibly located elsewhere).

This report presents the results of a preliminary environmental assessment of the project. We understand that this report will be considered (along with other reports) by GTR's Board before a decision is made on whether to proceed further with the project.

1.2 Scope of Work

The following scope of work was required by GTR (correspondence from Chris Laughton, 8 June 1998):

1. Address significant environmental issues relevant to the Main Creek area.
2. Comment on environmental aspects of the various mine plans considered, and in particular on the preferred mining option.
3. Detail requirements necessary to develop a full EMP on the mining project as part of, firstly, a pre-feasibility/indicative feasibility study and, secondly, a full feasibility study.
4. Detail the environmental approval process which would apply to the mining project.
5. Advise on any other matters relevant to the proposed mine site area.
6. Provide an indicative cost estimate and schedule to prepare a full EMP for the mine site development.
7. Identify key environmental issues which should be addressed with reference to the magnesium metal processing plant (the site for which is yet to be identified).
8. Outline the approval process which would apply to the processing plant.
9. Provide an indicative cost estimate and schedule to prepare a full EMP for the processing plant development.
10. Work closely with the project geologist and mining engineer to ensure that all relevant issues are addressed.
11. Prepare the report by 31 July 1998.

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NSR Environmental Consultants Pty Ltd	Location map		
Main Creek Magnesite Project			
Golden Triangle Resources NL	File No: 872/F1.1/HB	Job No: 872	Figure: 1.1

AMG 383050E
5372090N

5 cm

1.3 Limitations

This report addresses all of the tasks listed above. However, the detail which can be provided concerning the processing plant is limited by the fact that a site has yet to be chosen. Consequently, issues such as transport of the ore to the plant, power supplies, additional infrastructure, etc. are dealt with only on a generic basis. Similarly, the program of investigations and associated costs and schedule are, as requested, indicative only.

1.4 Basis for this Report

This report has been prepared on the basis of the following:

- NSR's proposal to Chris Laughton of 12 June 1998.
- GTR's acceptance of the NSR's proposal on 19 June 1998.
- Meeting at GTR's Melbourne office between Michael Jones (NSR), Chris Laughton (GTR), Lindsay Newnham (Newnham Exploration and Mining Services) and Gary Davison (BFP Consultants Pty Ltd).
- Site visit to the Main Creek area, 7 July 1998.
- On site (and subsequent) discussions between Michael Jones, Lindsay Newnham and Gary Davison.
- Meeting with Robert Hamilton of Forestry Tasmania and Lyndal Byrne of Burnie City Council on 8 July 1998.
- Review of relevant documents provided by GTR and other reference material (see Section 8 for details).

2. Project Concept

The current project concept provides for the mining and processing of magnesite ore to produce metallic magnesium. For this preliminary assessment, we have assumed that 60,000 tpa of Mg will be produced from 297,000 t of mined magnesite.

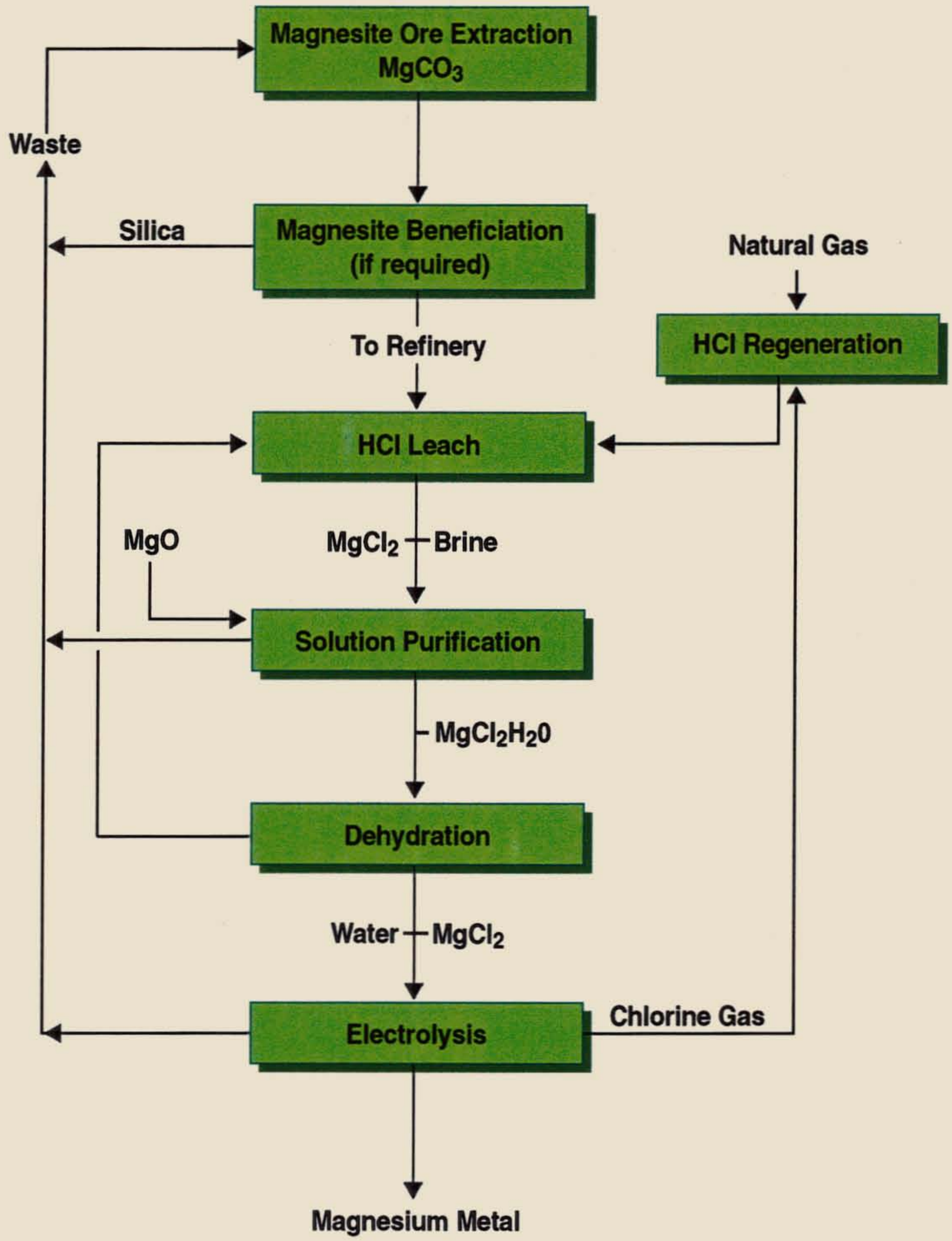
A preliminary project outline is normally required to determine the appropriate environmental investigations program. However, the current stage of project development does not permit such a project outline to be described with any confidence. Nevertheless, it is likely that the key components of the project will involve the following:

Mining

- A decision is still to be made concerning the mining method. Discussions with BFP indicate that two options are being considered:
  - Open cut mining in the Main Creek area. This would involve removal of the overlying vegetation and overburden, with conventional drilling, blasting, haulage and excavation. The pit would be located so as to avoid mining pyritic rock. The footprint of the mine would cover about 6 ha (5-year pit outline).
  - Underground mining in the Bowry Creek area. This would involve conventional cut and fill mining, with as much waste as possible being placed back underground. The footprint of the operation would cover about 4 ha (portal plus stockpiles plus quarry).

Ore Beneficiation, Transport and Processing (Figure 2.1)

- The degree of ore beneficiation which will be required depends on the quality of material being mined. Two options are available depending on the amount of silica contained within the mined material:
  - If significant amounts of silica are associated with the material, then a flotation circuit will be used to remove the silica. Current estimates are that up to 59,000 tpa i.e. 20% of the mined magnesite, could be rejected via flotation.
  - If only high-quality material is mined, then no flotation will be required.
- The remaining material will processed to produce Mg. At this stage no site for the refinery has been chosen i.e., possible locations include the mine site, the coast or elsewhere (including interstate options). Transport of ore between the mine and the refinery, assuming that the refinery is located on a site other than the mine site, could include:



NSR Environmental Consultants Pty Ltd	Magnesium production flowsheet		
Main Creek Magnesite Project			
Golden Triangle Resources NL	File No: 872/F2.1/HB	Job No: 872	Figure: 2.1

- Haul trucks using existing public roads; ore (or flotation concentrate) would be trucked from the mine (or beneficiation plant) to the refinery. Waste from the refinery (and the beneficiation plant if this were located at the refinery site) could be 'backloaded' to the mine site for disposal underground if appropriate.
- Railway using either the existing line or an extension of the existing line, with trucks providing the link between the rail terminal and the mine (or beneficiation plant).
- Pipeline, e.g. using the existing Savage River pipeline easement to Port Latta.

• In the refinery, the ore (or concentrate) will be leached in hydrochloric acid (with 93% efficiency) with subsequent electrolysis to produce Mg metal. Waste solids which will be generated include:

  - Leach residue (22,000 tpa) (comprising clays, quartz, oxides and other minerals).
  - Minor quantities of dust (10 tpa) extracted from hot chlorine leaving cells.
  - Material from cell rebuilds every two years (steel cathodes, graphite anodes and refractories).

  Waste liquids include:

  - Calcium chloride brine (40,000 tpa), which is possibly a saleable product as solids.
  - Waste water (8,000 tpa) containing about 2,000 t chlorine equivalent as a magnesium chloride/hydrochloric acid mixture from the scrubbing system.

  Gas emissions include:

  - Carbon dioxide (116,000 tpa) released from magnesite leaching.
  - Carbon dioxide (348,000 tpa), water vapour (290,000 tpa) and some nitrous oxides from energy generation from methane.
  - Carbon dioxide (100,000 tpa) generated from hydrogen production.
  - Minor quantities of non-condensable gases (possibly sulfur dioxide) from the gas scrubber system (3 tpa) and sulfur hexafluoride used for casting (8 tpa).

Waste rock

• The amount of waste rock generated and the subsequent management strategy will depend on the preferred mining method:

  - An open pit operation will require a dedicated waste rock dump adjacent to the pit.

- An underground mine will require temporary surface storage of the material prior to placement back underground as fill. The surface storage area could be coincident with the site of a quarry which may need to be developed to provide sufficient volumes of fill.

Tailing

- Low quality magnesite rejected during flotation will be generated at a rate of about 59,000 tpa as tailing.
- Leach residue (22,000 tpa) will be generated in the refinery.
- Various tailing disposal options are possible, such as a conventional wet tailing impoundment, dry stacking, or paste production and backfilling of mined out areas. In general, the terrain around the mine area offers limited opportunities for stable and permanently safe storage. Tailing containment structures in valley situations are likely to be difficult to design and expensive to construct, maintain and decommission.

Infrastructure

Ancillary infrastructure includes a port and storage facilities, electrical power, water supply, quarries for fill and construction materials, and workforce accommodation.

- We have assumed that the existing port facilities at Burnie will be used for all project-related shipping activities.
- The projected electrical power demand is approximately 120 MW. While power for mining and beneficiation could be obtained from the existing Tasmanian grid via an additional transmission line from the Savage River Mine, insufficient power is currently available to service the refinery. Additional power would therefore need to be provided, possibly from Victoria via a Bass Strait link or from gas fields in Bass Strait which are currently under exploration by third parties.
- Potential water supplies for mining and beneficiation are available from the Main Creek/Savage River system.
- The project's workforce will be sourced from a combination of local people and people from elsewhere in Tasmania and Australia. We have assumed that local people will continue to live within their existing communities and will be bussed to site. Non-local people will be accommodated either by existing housing in local townships such as Burnie or by the provision of new housing in these same towns. Given the large number of skilled construction workers that will be required during the construction phase, we have assumed that a temporary dormitory style camp will be required for that phase.

3. Environmental Setting and Issues

3.1 Background

This section outlines the environmental setting and sensitivities of the Main Creek Project and allows the environmental issues to be placed in context. Given the lack of information about the possible location of the refinery, Section 3.2 (Environmental Setting) addresses only the mine area while issues relevant to both the mine and the refinery are discussed in Section 3.3.

3.2 Environmental Setting

3.2.1 General

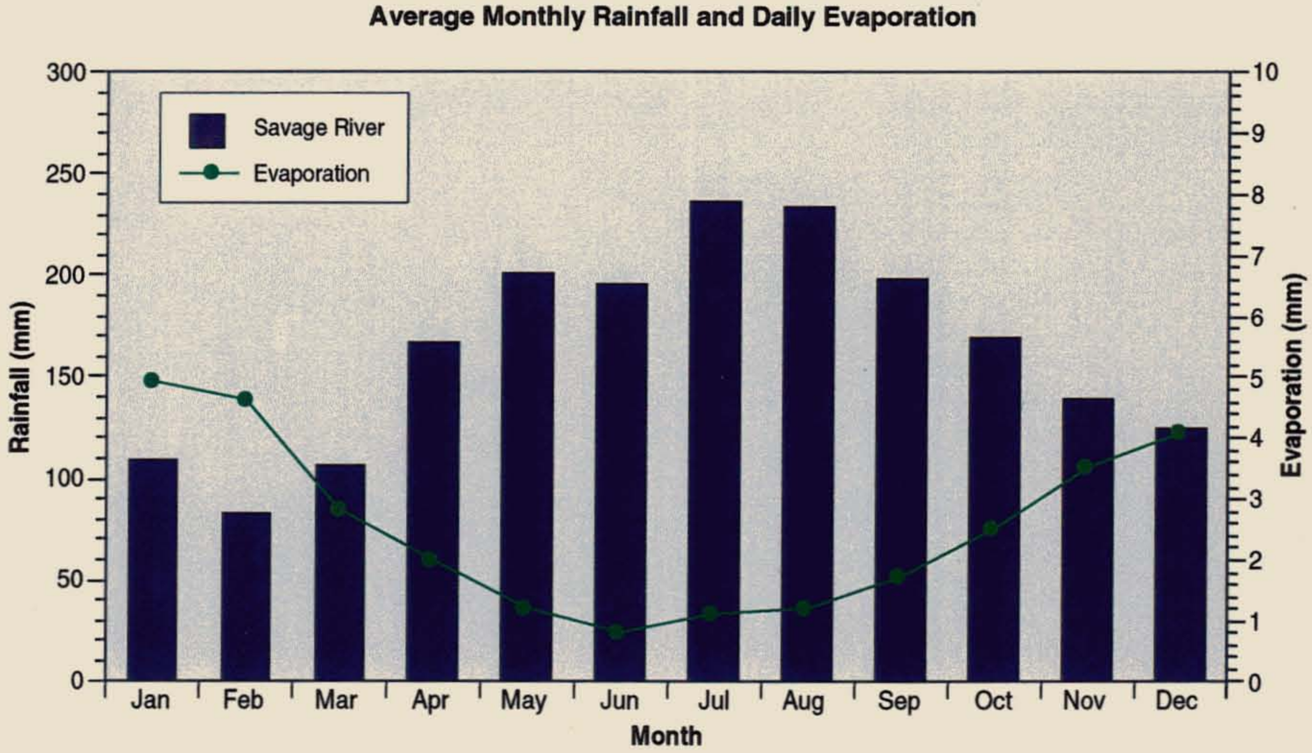
The Main Creek project area is relatively isolated, being situated about 50 km west of the Murchison Highway (see Figure 1.1). The nearest localities are Corinna (population 6) to the southwest and Waratah (population 380) to the northeast. The town site of Luina, to the east, is no longer occupied. The nearest major town by road is Burnie (population ~20,000), about 110 km to the northeast. The township of Savage River, which once had a population of 1500, has been largely demolished and the area rehabilitated. The remaining buildings at the Savage River site now function as an accommodation centre for Australian Bulk Minerals' (ABM) workforce at the refurbished Savage River Mine.

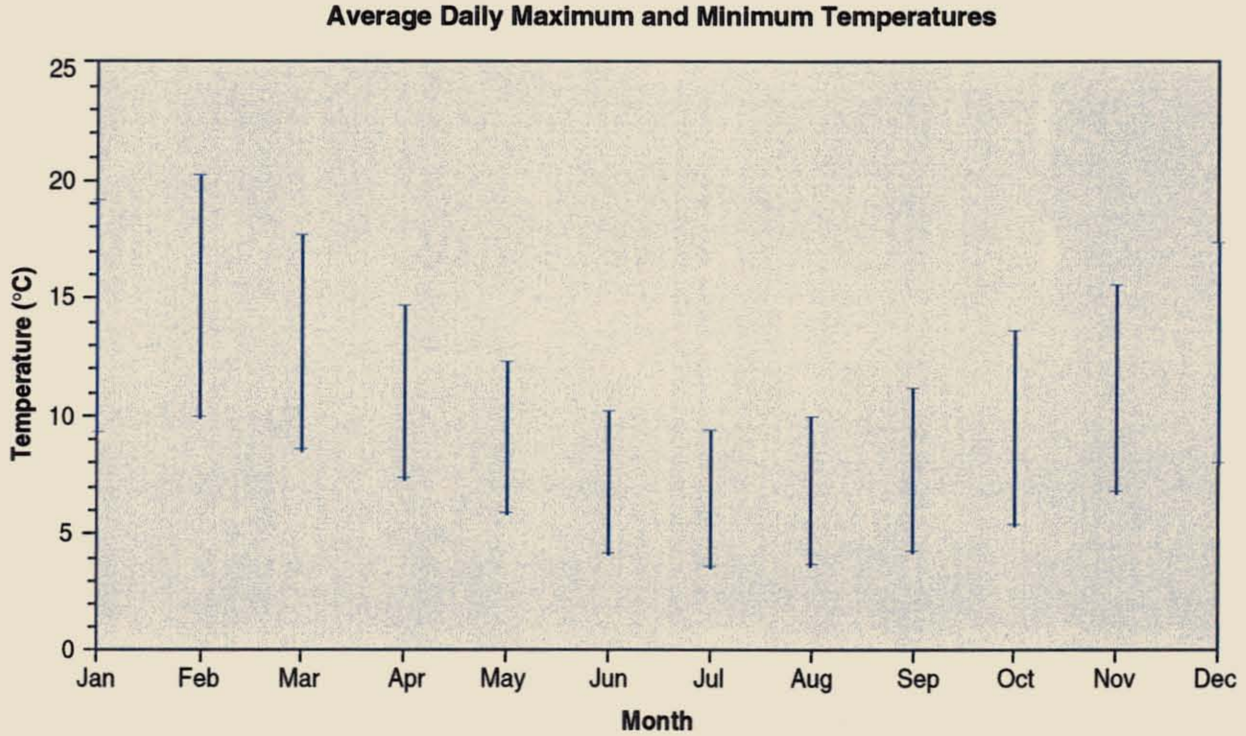
The general area has a history of exploration and prospecting since the 1800s, although this was impeded by the rugged terrain and difficult vegetation. The Savage River magnetite deposits located immediately north of the Main Creek area were discovered in 1877. Open cut mining operations at the Savage River Mine eventually commenced in 1967 and ceased in April 1996, until ABM re-opened the mine in late 1997. Elsewhere in the immediate area, mine fields were established at Waratah and Corinna, peaking at the turn of the 19th Century.

3.2.2 Climate

The Bureau of Meteorology established a meteorological station at the Savage River Mine (latitude 41°29'25" S, longitude 145°12'03" E, elevation 229 m) in January 1966. Temperature, evaporation, cloud cover, sunshine and wind speed were recorded for up to 23 years, while rainfall continues to be recorded. Data from this station is used to describe the local climatic conditions at Main Creek.

The climate of the project area is characterised by cool temperatures, and high and consistent annual rainfall. Rainfall distribution in western Tasmania is generally high throughout the year, with June to September being the wettest months and December to March the driest. Drought conditions are rare. The data shown in Figure 3.1 for the Savage River Mine confirms this distribution, with an average annual rainfall at the Savage River Mine site of almost 2,000 mm (1,954). The corresponding mean annual evaporation rate—921 mm—is amongst the lowest in Australia. Rainfall exceeds evaporation by a factor of about 2.1.





NSR Environmental Consultants Pty Ltd	**Rainfall, evaporation and temperature at Savage River Mine**
Main Creek Magnesite Project	
Golden Triangle Resources NL	File No: **872/F3.1/HB** · Job No: **872** · Figure: **3.1**

Mean monthly minimum and maximum temperatures at Savage River range from 3.5 - 9.3°C in July to 9.9 - 20.1°C in February (Figure 3.1). Although not exposed to extreme and persistent winter conditions, the area is subject to an average of 24.6 days of frost and 5.5 days of snow per year.

Average daily sunshine in the region is low by Australian standards. Savage River experiences 4.8 daily hours of sunshine annually.

The mine is located in the pathway of the strong westerly winter winds known as the 'Roaring Forties'. On average, there are 17.9 days annually of strong winds and 1.4 days of gales[1]. However, the local occurrence of strong winds is highly site-specific and depends on topographic exposure (Bureau of Meteorology, 1996, pers. comm.).

3.2.3 Land Tenure and Land Use

The mine area is located within the Municipality of Waratah-Wynyard and the general area has been zoned 'rural' by the Waratah-Wynyard Council Section 46 Planning Scheme 1993. This is a zone in which extractive industries are a permitted land use. The closest adjoining lease is the Savage River Mine lease located several hundred metres northeast of the GTR lease (Figure 3.2). Mining easement 3W/94 connects the Savage River Mine lease to the GTR leases and access is also available from the Corinna Road via mining easement 4W/94 (Figure 3.2).

The Main Creek area and surrounds have been under commercial and recreational land use for many years. Current land uses comprise mineral exploration, general nature conservation, walking, fishing, photography and off-road vehicle driving. Notwithstanding these multiple land uses, the proposed mine area is within the boundaries of the Tarkine Wilderness Area which is interim listed on the Register of the National Estate compiled by the Australian Heritage Commission[2]. In addition to ecological, geological and geomorphological attributes, the AHC regards the general Tarkine area as being of importance (AHC, undated):

> . . . because of its remoteness and integrity. . . its aesthetic qualities and parts of the area . . . having high or outstanding landscape quality.

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[1] Days of strong wind are defined as days for which a mean wind speed exceeding 40 km/h (Beaufort Force 6) is sustained for 10 minutes or more during the day. Days of gale are similarly defined for a wind speed of 63 km/h (Beaufort Force 8).

[2] It should be noted that entry in the Register of the National Estate is not a land management decision. The Commonwealth Government is the only body whose actions are constrained by such a listing.

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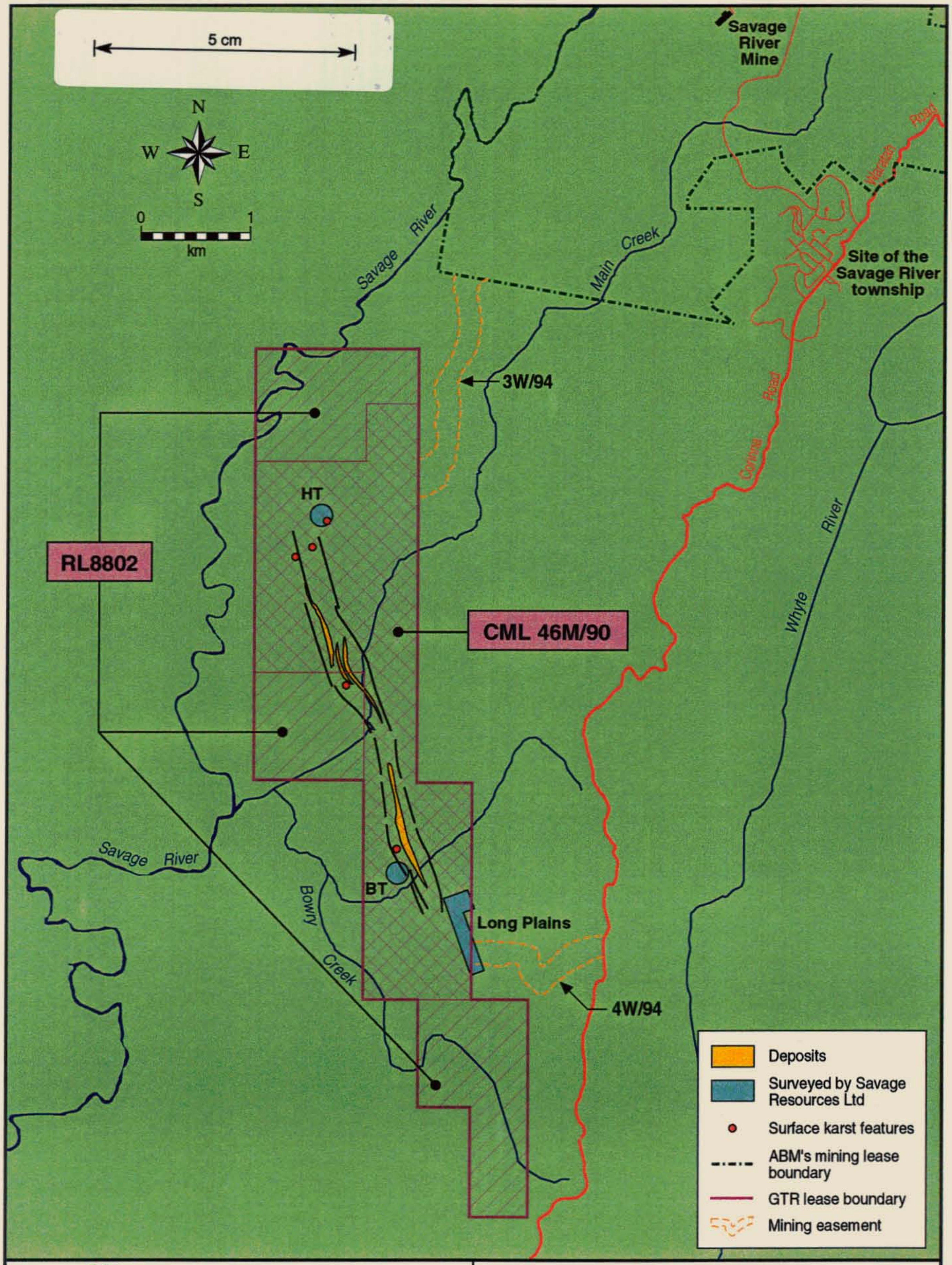

NSR Environmental Consultants Pty Ltd	Project area		
Main Creek Magnesite Project			
Golden Triangle Resources NL	File No: 872/F3.2/HB	Job No: 872	Figure: 3.2

This interim listing is tempered by the fact that, although the AHC assessed the condition of the Tarkine as being generally very good, it was noted that there were limited areas which had been subjected to intensive forestry operations, small scale mining and mineral exploration. This description is applicable to the mine area. Also, as described in Section 3.2.10, Savage River and Main Creek have both been significantly adversely affected by the Savage River Mine. This is noted in the assessment of wilderness values which was undertaken as part of the Regional Forest Agreement (RFA), which was signed between the Australian and Tasmanian governments in November 1997. In this assessment, the proposed mine area and immediate surrounds were excluded from the high quality wilderness category. As described in the RFA, the mine area is classified as State Forest, a category in which mining is permitted (R. Hamilton, Forestry Tasmania, pers. comm.).

3.2.4 Physiography and Topography

The project area is located in rugged, mountainous and densely forested terrain (Plate 1) within the easternmost extension of the Western Ranges physiographic region of central west Tasmania. The area is characterised by erosional and depositional glacial landforms and consists of Precambrian and folded Palaeozoic rocks with topography and drainage largely controlled by major structural trends.

3.2.5 Geology and Geochemistry

As described in Newnham (1998), the Main Creek magnesite deposits occur in the Bowry Formation within the Arthur Metamorphic Complex (AMC). The Bowry Formation comprises pelitic schists and amphibolites and hosts magnetite deposits (such as those at Savage River and Long Plains), various silica deposits, and magnesite deposits such as at Main Creek-Bowry Creek. The drilling program undertaken by GTR suggests that the magnesite deposits are hosted by a carbonate-rich sequence of rocks, bounded by pelitic schists and amphibolites. The hangingwall and footwall schists are both pyritic, while the carbonate sequence:

> is defined as a package of carbonate lenses (magnesite and dolomite) with interbedded calcareous and pyritic schists.

It is likely that the pyritic material found in the Main Creek-Bowry Creek magnesite deposits will exhibit geochemical characteristics similar to those found at the Savage River Mine, where pyrite forms 5% of the ore body. A key feature of this pyritic material is its potential to oxidise and form acid. Much of the material associated with the project is therefore likely to be either acid forming or potentially acid forming[3].

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[3] Acid generation is a characteristic feature of the Savage River Mine. For example, the Centre Pit median pH value for water discharging to Savage River from the pit in the period April 1995 to July 1996 was 4.6, and elevated concentrations of Cu, Mn and Ni (as well as sulfate) were recorded.

Plate 1 Heavily forested valley near Main Creek

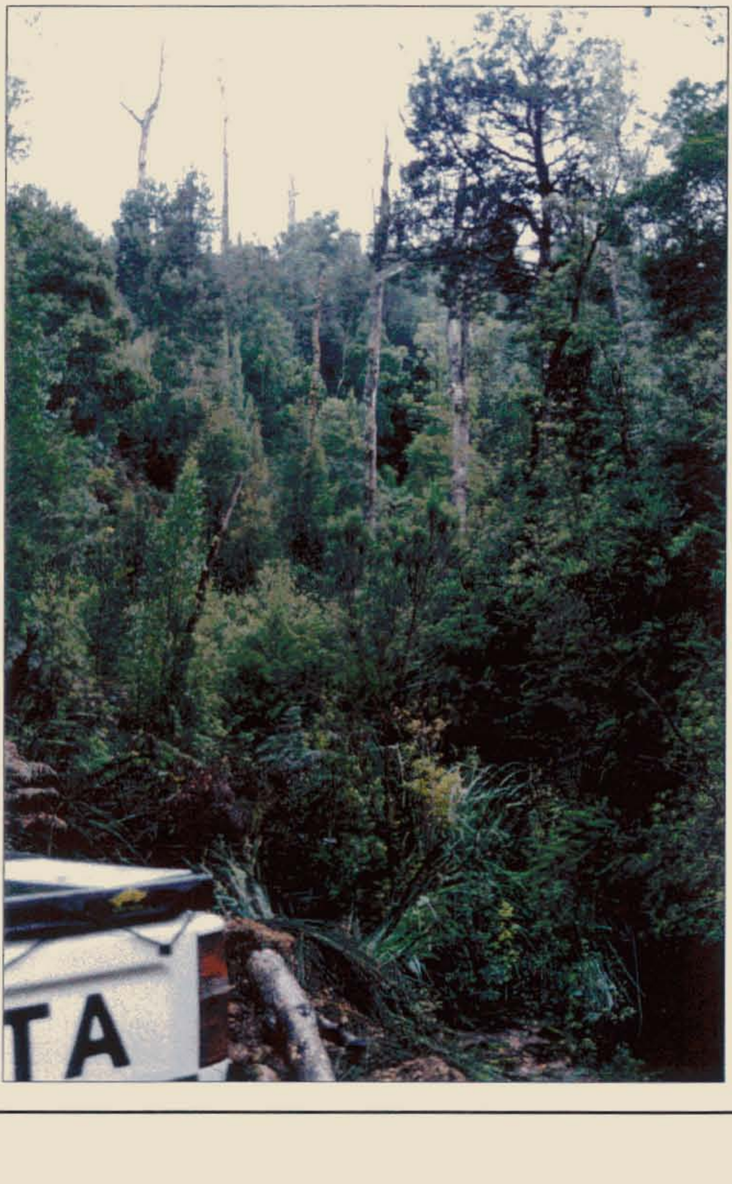

Plate 2 Forest re-generation after bushfire, Bowry Creek catchment

Notwithstanding this acid generating potential, considerable buffering capacity exists in the surrounding carbonaceous material which could be used to neutralise any acid formed.

The occurrence in the Main Creek/Bowry Creek area of karst landforms of national significance is reported by Sharples (1996) in his review of landforms and geological sites of geoconservation significance in this region. The comment is made that the:

> . . . main karst assemblage at Main Rivulet (is) in good condition; other features not assessed.

In work undertaken for Savage Resources Ltd, Shannon (1993) pointed out that:

> Genuine karst features, albeit on a small scale, including residual pinnacles with undercuts, short streamway caves and springs occur in some of the outcrops of magnesite rock associated with some incised streambeds in the Main Creek - Bowry Creek magnesite area generally. These features are of enhanced scientific interest in view of the extremely rare status of the magnesite karst . . .

The locations of the various surface karst features noted by Shannon (1993) are shown in Figure 3.2.

In the Statement of Significance for the Tarkine Wilderness Area, the AHC noted that (AHC, undated):

> The magnesite karst in the Savage River area is a very rare formation on a global scale.

3.2.6 Terrestrial Flora

Like much of the cold temperate rainforest climax vegetation of western Tasmania, the vegetation of the project area is characteristically altered into a complex mosaic of differing floral associations in various stages of successional development after fire (Plate 2).

A review of the vegetation of the Savage River area immediately north of Main Creek was undertaken in NSR (1997). Extending the descriptions into the project area, the vegetation can be described as comprising rainforest communities (callidendrous) and mixed forest and wet sclerophyll communities (Duncan and Packham, 1994). The Tasmanian Herbarium (1995) surveyed the Long Plains area located in the headwaters of Bowry Creek (Figure 3.2) on behalf of Savage Resources Ltd and similarly reported a relatively uniform mixed eucalypt/ rainforest community. A similar survey in an area called "BT", located several hundred metres from the Long Plains area (Figure 3.2), reported thamnic rainforest regenerating after a wildfire in 1982 (Tasmanian Herbarium, undated). This regrowth was also evident in the Long Plains area, as was selective logging. Mature thamnic rainforest was reported for an area north of Main Creek ("HT") (Figure 3.2) which was not affected by wild fire.

No weeds were evident during the site inspection. However, broom is prominent along the road from Waratah to Savage River and *Cirsium vulgare* has been reported in the Long Plains area (Tasmanian Herbarium, 1995). Signs of *Phytophthora cinnamomi,* (Dieback or Rootrot)[4] or myrtle root, while not noted during the site visit or in previous botanical surveys of the immediate area, has been recorded elsewhere in the region and would require further investigation.

3.2.7 Terrestrial Fauna

Compared to other parts of mainland Australia, the range of Tasmanian mammalian species is depauperate and is associated with reduced competition between species and a broadening of the range of habitats occupied (Hocking and Guiler, 1983).

As with terrestrial flora, a review of terrestrial fauna for the Savage River was undertaken in NSR (1997). By analogy, it is reasonable to assume that faunal species found in the project area are common along the West Coast in similar habitats of dense temperate rainforest and wet sclerophyll forest. A low level of mammal activity is a feature of the dense wet forests of western Tasmania and hence is also expected to be a feature of the project area, with the dominant mammal fauna being small ground foragers.

Rainforest avifauna is expected to be somewhat depauperate in the project area (as elsewhere on the West Coast) compared with the drier eastern parts of Tasmania. This can be attributed to the closed canopy reducing the availability of soft food and restricting access to invertebrate food.

3.2.8 Archaeology, Conservation and Heritage

The general Savage River area has a paucity of archaeological sites, which has previously been attributed to the densely vegetated and inhospitable nature of the region (Miedecke, 1996). In work undertaken for Savage Resources Ltd, du Cros and Associates (1993, 1995) and CHC (1995) surveyed a number of areas in the proposed mine area (Figure 3.2) and reported finding no Aboriginal or historic European archaeological sites, nor were areas of archaeological sensitivity noted. Similar findings would be expected for GTR's mine area footprint, although this would need to be confirmed by survey.

3.2.9 Hydrology

Main Creek is a tributary of the Savage River which flows into the Pieman River 25 km downstream of the mine area, which in turn flows into the southern ocean

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[4] This is an introduced plant fungus which causes dieback and death in many native plant species. The fungus is water-borne and lives in soil. One of the main means of spread of the fungus is by carriage of soil particles from infected to uninfected areas via walkers, vehicles and earth-moving equipment.

at Hardwick Bay 15 km to the west (see Figure 1.1). The Main Creek catchment (excluding Bowry Creek) has an area of some 15 km^2, while that of Bowry Creek is about 12 km^2. Both of these are sub-catchments of the Pieman River, which has a total catchment area of 3,800 km^2.

Figure 3.3 shows mean monthly discharge for the Savage River from 1979 to 1990 at Gauging Station 10202, located near the confluence of the Savage and Pieman rivers. Discharge is highly seasonal, with maximum mean discharges (which generally range from 20 to 30 m^3/sec) occurring from June to October, and minimum mean discharges (which generally range from 1 to 3 m^3/sec) occurring from December to April. The flow exceedence data for this station shows that the median discharge is 7 m^3/sec, and that a discharge of 2 m^3/sec is exceeded for 90% of the time while a discharge of 30 m^3/sec is exceeded 10% of the time. Data for a gauging station located on Main Creek (Plate 3) was not available for this report.

3.2.10 Surface Water Quality

Water quality objectives to determine the required level of protection are based on the environmental values (also known as beneficial uses) of the particular waterbodies. ANZECC (1992) defines five environmental values:

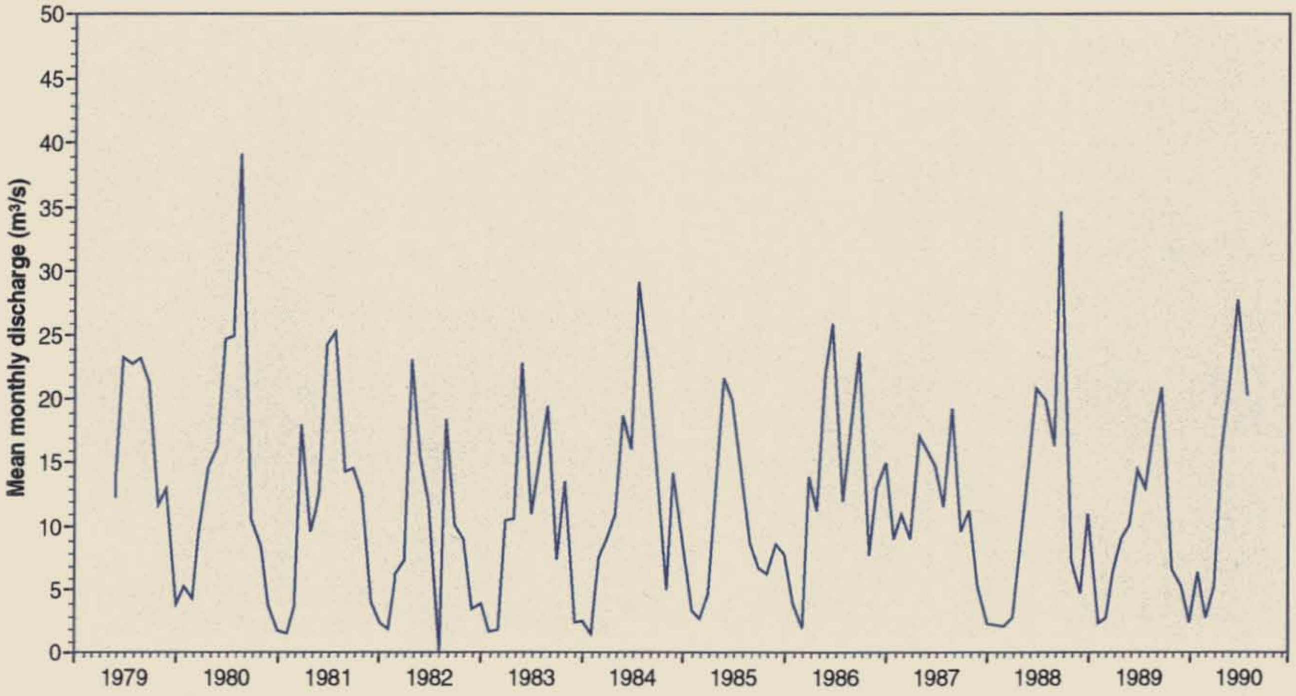
- Ecosystem protection.
- Recreation and aesthetics.
- Raw water for drinking water supplies.
- Agricultural water (i.e. for irrigation and livestock watering).
- Industrial water.

For water quality indicators such as pH, conductivity and toxicants (e.g. trace metals), the highest quality water is generally that required for the protection of aquatic ecosystems. For Main Creek and Bowry Creek, ecosystem protection and recreation are considered to be the applicable values.

Streams in western Tasmania are characterised by:

- High humic acid concentrations reflected in elevated dissolved organic carbon (DOC) levels and neutral to slightly acidic pH values.
- Low alkalinity, conductivity and total suspended solids (TSS) values.
- Low concentrations of trace metals.
- Significant ability of the dissolved humic material to complex trace metals such as copper (Cu).

These features are clearly shown by Koehnken (1992) in the 15-month Pieman River Environmental Monitoring Program. The waters of Bowry Creek (Plate 4) are expected to exhibit these characteristics. In contrast, Main Creek waters are expected to be of relatively poor quality due to input from the Savage River Mine upstream of the project area.



NSR Environmental Consultants Pty Ltd	Mean monthly discharge for the Savage River at GS 10202		
Main Creek Magnesite Project			
Golden Triangle Resources NL	File No: 872/F3.4/HB	Job No: 872	Figure: 3.3

Plate 3 Stream discharge station on Main Creek

Plate 4 Bowry Creek

This is shown in the results of a detailed assessment of Savage River water quality, which was undertaken as part of the permitting process for ABM's refurbishment of the Savage River Mine (NSR, 1997). This assessment shows how Main Creek and Savage River reflect the influences of past mining. Problematic contaminants include suspended sediments and acid mine drainage containing elevated dissolved Cu and manganese (Mn).

The results from an earlier study of the downstream effects of the Savage River Mine on aquatic biota in Savage River, undertaken prior to ABM's refurbishment of that mine, can be summarised as follows:

> the faunal communities . . . have suffered severe impacts consistent with major changes in water quality and sediment characteristics;
>
> little recovery is occurring downstream from the ameliorative action of inflowing tributaries;
>
> the degree of impact is sufficiently severe to eliminate up to 90% of the major taxa (families) of aquatic macroinvertebrates and to decrease overall abundance by up to 99% in the reach downstream of the confluence with Main Creek.

It can be expected that these conclusions apply at least in part to Main Creek downstream of the Savage River Mine (and therefore within the project area), and that a severely degraded aquatic ecosystem occurs in Main Creek downstream of the Savage River Mine (Plate 5) due to both mine-derived trace metals and sediment[5]. This would need to be confirmed by survey.

The implications of excessive sediment generation with respect to downstream recreational pursuits have been assessed by Koehnken (1992):

> Although the concentration of sediments (from the Savage River) measured does not pose a threat to the (Pieman River) ecosystem, the plume is an aesthetic problem in a tourist (sic) receiving more than 2000 tourists over the past year.

The poor water quality in Main Creek was confirmed in a study undertaken by ABM in mid-1997 and reported in NSR (1998). Drainage from Savage River Mine's B Dump, which contains acid generating material, reports to Main Creek (with the creek actually flowing through the toe of the waste rock dump in two places), as does seepage and discharges from the Savage River Mine's Main Creek Tailing Dam. The study showed low pH and high metal concentrations in Main Creek.

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[5] Trace metals can have direct toxicological effects on aquatic biota, while sediment can fill the interstices in the bed sediments, thereby substantially altering the benthic habitats and associated fauna.

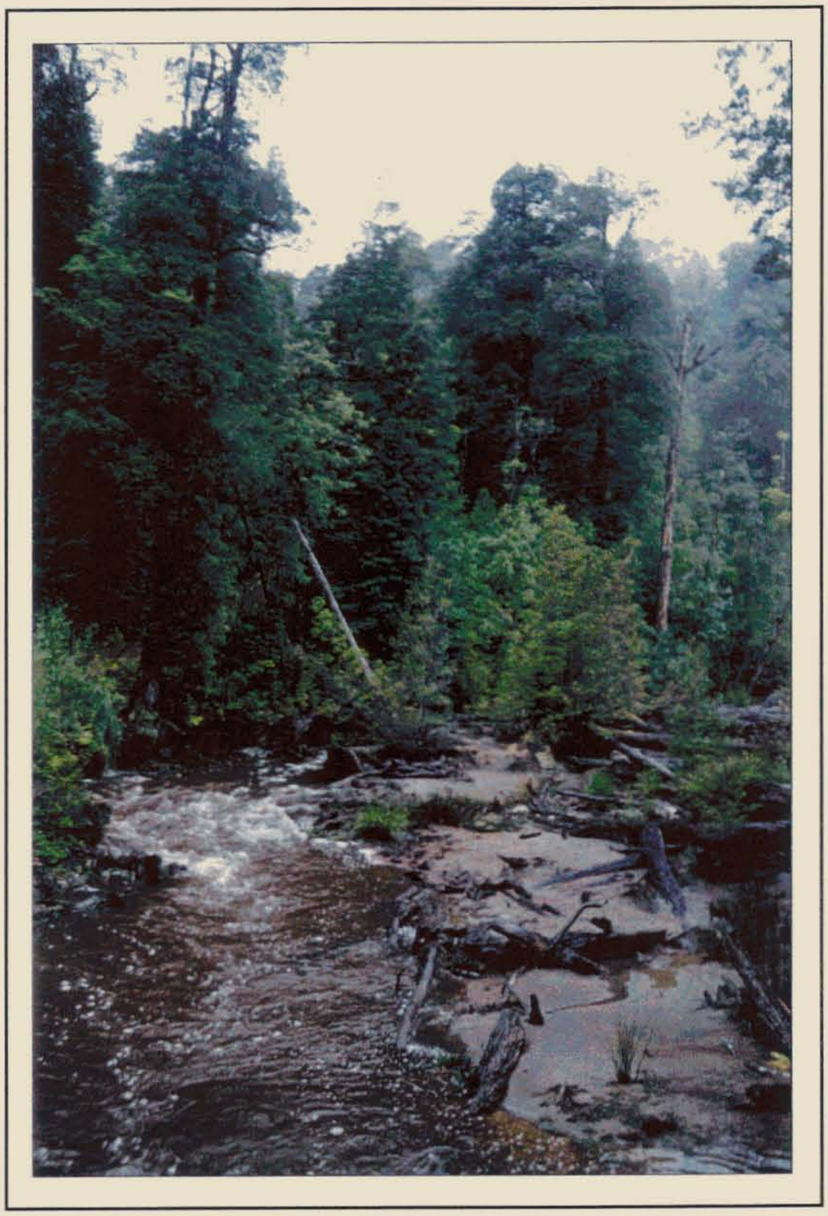

Plate 5 Main Creek downstream of the Savage River Mine

It is therefore apparent that Main Creek water quality in the project area is likely to be poor, being acidic and with elevated concentrations of major ions and trace metals. Concentrations of TSS are likely to be elevated during flood events when high discharge causes increased input of erodible material from the river catchment (particularly the Savage River Mine) and resuspends previously deposited material within the stream bed.

3.2.11 Groundwater

No information was available concerning the hydrogeological conditions in the project area. However, the evidence of both ABM's operation at Savage River and GTR's exploration program suggests that there is an abundance of groundwater. This is consistent with the experience of other mines in the region and reflects a geological environment of tightly folded and fractured bedrock and a high rainfall environment.

3.3 Environmental Issues

Given the notional project outline described in Section 2 and the environmental setting described in Section 3.2, the key environmental issues raised by the future development of a mine, refinery and associated infrastructure are:

- The extent of direct land alienation, in particular:
  - Loss of existing land uses where project components will be located. This includes the forested mine area and any areas eventually chosen for the refinery. While this is expected not to be a significant issue at the mine site, its significance with respect to the refinery depends largely on the refinery's location.
  - Effects on biodiversity and conservation values. From a regional context, it is likely that the species and vegetation communities and the associated fauna in areas which will be disturbed by the mine are adequately represented elsewhere in Tasmania, particularly along the West Coast, notwithstanding the mine area's location within the Tarkine Wilderness Area. This view is reinforced by the report prepared by the Tasmanian Herbarium (1995), in which it was concluded that the type of vegetation community in the area is widespread, having no vascular plant species of high conservation significance. The significance of this issue with respect to the refinery depends largely on the refinery's location.
  - Effects on karst landforms developed in magnesite carbonate rock. As mentioned in Section 3.2, surface karst features in the mine area have been described as significant.
- Water management and the effects of runoff from the project area and/or project facilities on beneficial uses of the downstream waters, with particular emphasis on:

- Impacts associated with possibly elevated suspended sediment concentrations or other contaminants (e.g. trace metals such as Cu or Mn).
- The potential for ore, overburden and tailing to generate acid due to the oxidation of contained sulfide minerals.
- Effects of one or more possible stream diversions.

- The potential for GTR to be held responsible for degradation of the aquatic environment downstream of the mine area. As noted previously, Main Creek and Savage River are already impacted by previous mining activities. In addition, ABM has recommenced operations at the Savage River Mine and DELM is undertaking rehabilitation of areas of the Savage River Mine. Both of these actions could result in ongoing contamination of Main Creek and Savage River. Therefore, at least two issues need to be addressed:
  - An appropriate framework (legislative or otherwise) needs to be established whereby GTR is clearly not held responsible for pollution caused by others.
  - The existing status of these areas needs to be ascertained so that baseline conditions prior to GTR's activities can be established.

- The 'outrage' factor i.e., the extent to which general antagonism to the project might be generated throughout the community (and not necessarily related to the facts). A review of articles which have been published in the Mercury (Hobart) newspaper in the first six months of 1998 and which concern magnesite projects shows a degree of confusion between GTR's project and Crest Resources NL's proposed underground magnesite development located near the Arthur and Lyons Rivers, north of the Savage River Mine. Issues which have been raised include magnesite caves and general wilderness values, although these have generally been in reference to Crest's project. The Tasmanian Greens appear to be more supportive of GTR's project, and have been quoted as saying that:

  > We are optimistic there is a potential to mine and process magnesite from Savage River, without affecting the Tarkine wilderness.

  Consultation will therefore be required with groups such as the Tasmanian Greens, The Wilderness Society, Tasmanian Conservation Trust, Club Tarkine, Friends of the Tarkine, Tarkine National Coalition and the North West Walking Club, if only to allay fears and misconceptions about the project and to ensure that the general public does not confuse GTR's project with other similar developments.

- Permanent storage of waste solids will be an issue if using all solids as backfill is not an option.

- Socio-economic effects on towns and communities associated with or affected by the development. While both positive and negative effects are possible, it is likely that the positive effects such as annual royalties, direct contributions to the local economy through the purchase of goods and services, and increased employment opportunities (both direct and indirect) will outweigh the negative effects.

- The scale and nature of rehabilitation of the mine site and refinery, and the long-term integrity, end use and rehabilitation of tailing impoundment(s).
- Potential air quality impacts. These include dust in the mine area and along haul roads, various gaseous emissions from the refinery (but particularly the potential for acid mist from the acid plant and leach process), and combustion products from energy conversion sources.
- Mining operation noise arises from drills, shovels, blasting, and dumping/haulage of ore and overburden. The absence of nearby human habitation ensures that no significant noise levels are likely to be experienced by non-mining personnel. Process noise from the refinery may be an issue, depending on the refinery's location.
- Potential effects on archaeological or cultural sites. Given the findings described in Section 3.2, this is unlikely to be a major issue.

Other minor issues which will need to be addressed include chemicals management, hydrocarbons management, fire control, weed and pest (e.g. feral cats/bees) control, general waste management, public safety risks due to increased road traffic, and hazards or risks associated with shipping consumables/product through the Port of Burnie (e.g. ship discharges, risk of collision, etc).

4. Approvals and Permitting Process

4.1 General Regulatory Environment

Since the *Environment Protection Act* (EPA) (1973) and associated regulations were enacted in the early 1970s, Tasmania has undergone a complete review of all planning and environmental legislation. This has led to the formulation of the *Environmental Management and Pollution Control Act* (EMPCA) (1994), which differs significantly to the EPA (1973) by integrating environmental approvals with the approvals process under the *Land Use Planning and Approvals Act* (LUPAA) (1993), and adopting sustainable development philosophies.

Some of the more relevant acts, regulations and statutes which are likely to be applicable to the project are shown in Table 4.1.

4.2 Environmental Approval Process

According to Schedule 2 of the EMPCA (1994), both the mine and refinery can be classified as Level 2 activities. The application for environmental approval for these activities is part of an application made to the local Planning Authorities under the LUPAA (1993), as shown in Figure 4.1. The environmental assessment focuses on the process described in Section 25 of the EMPCA (1994), which in turn makes reference to the environmental impact assessment (EIA) provisions described in Sections 73 and 74 of the EMPCA (1994).

In practice, the Planning Permit application(s) submitted to the Planning Authorities will include the Development Proposal and Environmental Management Plan (DPEMP), where a single DPEMP will be prepared which addresses all aspects of the project. If the mine and refinery are located in different municipalities, then an application will need to be submitted to the Planning Authority responsible for each area. Guidelines for the DPEMP will probably be issued by DELM and are likely to require a description of the proposed operation, an environmental management plan, environmental management strategies and a summary of environmental commitments. The application(s) will be referred by the Planning Authorities to DELM (in its role as an advisory body to the Board of Environmental Management and Pollution Control) and, providing that adequate information is contained within the document, the DPEMP will be placed on public display. DELM will assess the resulting comments and, in conjunction with its own assessment of the document, will prepare a report to be considered by the Board. After public consultation, the Board will either notify the Planning Authorities of conditions which need to be incorporated in the planning permit(s) or direct the Planning Authorities to refuse to grant a permit(s). The permit(s) may contain additional conditions inserted by the Planning Authorities.

It is likely that an Environmental Management Plan (EMP) review will need to be conducted 12 months after commencement of operations. Subsequent updates of the EMP are then likely to be required at 3-yearly intervals.

Table 4.1

Relevant Acts, Regulations and Statutes

Primary Acts and Regulations • Environmental Management and Pollution Control Act (1994) • Land Use Planning and Approvals Act (1993) • Environment Protection Act (Water Pollution) Regulation 1974 • Environment Protection Act (Water Pollution by Oil and Noxious Substances) Regulations 1989 • Environment Protection (Waste Disposal) Regulation 1974 • Environment Protection (Noise) Regulation 1977 • Environment Protection (General) Regulations 1974 • Environment Protection (Atmospheric Pollution) Regulations 1974 • Dangerous Goods Act 1976 and Regulations • Chloro Fluorocarbons and Other Ozone Depleting Substances Control Act 1988 • Forest Practices Act 1985 • Forestry Legislation (Transitional Provisions) Act 1994 • Forestry Rights Registration Act 1990 • Mineral Resources Act 1951 • Mineral Resources Development Act 1995 • Mines Inspection Act 1968 • Mining Act 1958 • Native Forestry Agreement Act 1980 • Native Title (Tasmania) Act 1994 • Pollution of Waters by Oil and Noxious Substances Act 1987 • Threatened Species Protection Act 1995 • Mines Inspection Regulations 1991 • Mines Inspection (Medical Examinations) Regulations 1991 • National Parks and Reserves (General) Regulations 1971 • Workplace Health and Safety Act 1995
Ancillary Statutes • State Policies and Projects Act (1993) • Aboriginal Relics Acts (1975) • Mines Inspection Act (1968) and (1972) • Fire Services Act (1979) • Groundwater Act (1985)
Australian Standards • AS1216 Classification Hazard Identification and Information Systems for Dangerous Goods • AS1940-1992 Storage and Handling of Flammable and Combustible Liquids • AS2243-10 Chemical Storage • AS2508 Safe Storage and Handling Information Cards for Hazardous Materials • AS/NZS ISO 14001 (Int):1995 Environmental Management Systems - Specification with Guidance for Use • ASNZS ISO 14004 (Int): 1995 Environmental Management Systems - General Guidelines on Principles, Systems and Supporting Techniques

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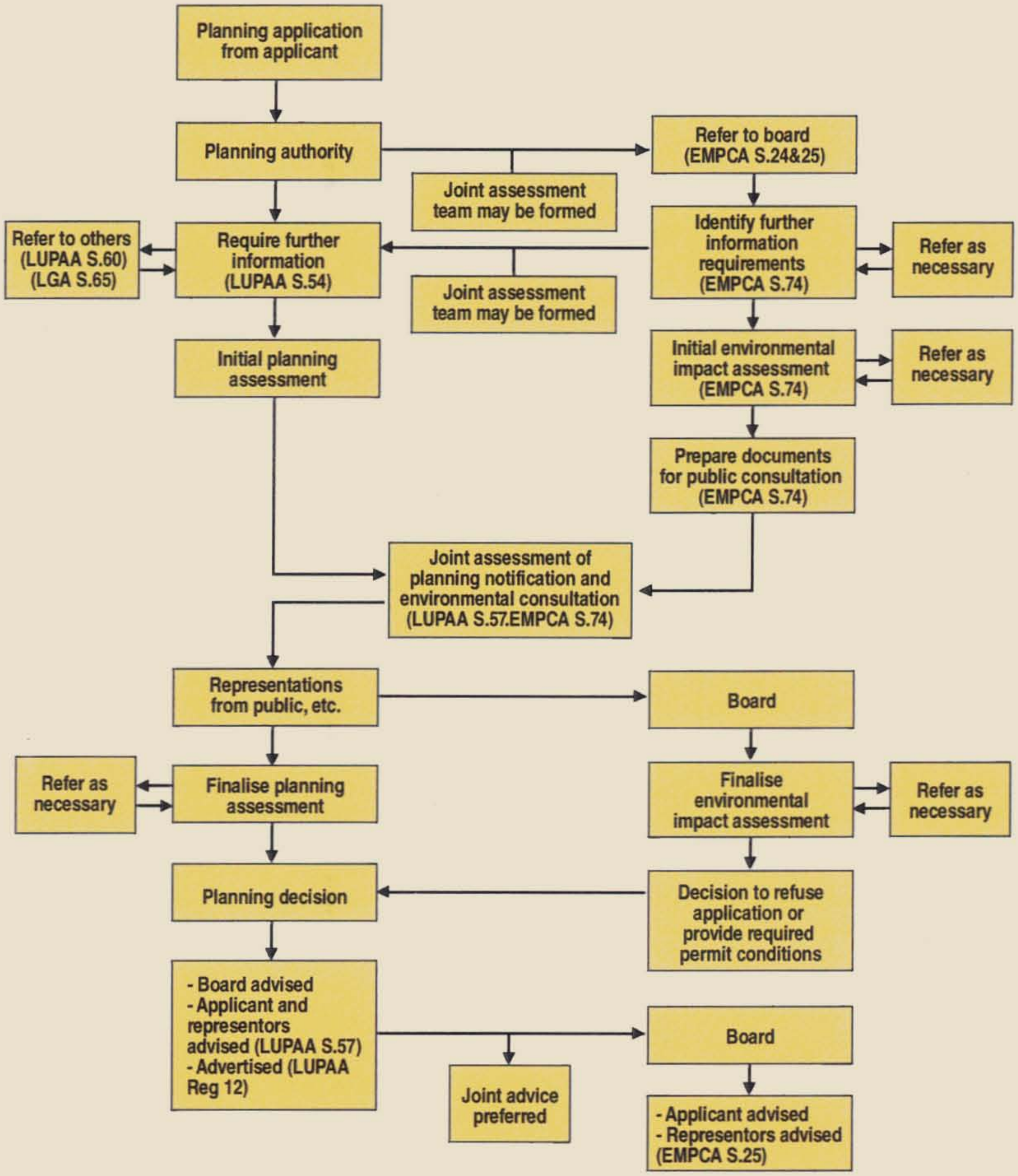

NSR Environmental Consultants Pty Ltd	Environmental approval process for magnesite mine and refinery		
Main Creek Magnesite Project			
Golden Triangle Resources NL	File No: 872/F4.1/HB	Job No: 872	Figure: 4.1

5. Future Work Program

5.1 Approach and Timing

Although some information is available concerning the project and the project area, additional work is required before the feasibility of developing a mine and refinery can be demonstrated. While we understand that GTR is encouraged by initial exploration results and preliminary economic evaluations, there is no certainty that a mine can be developed in the future. However, systematic environmental investigations at this early stage will ensure that environmental issues are thoroughly researched and resolved in a timely fashion prior to development.

The proposed environmental work program is based on the general principle that prior to a decision to develop the project, the level of effort expended on environmental investigations will be sufficient to satisfy project planning and feasibility requirements without increasing premature expenditure or delaying the project schedule. This will ensure that:

- At any time, the level of activity on environmental investigations is commensurate with GTR's confidence in the project.
- Commencement of different phases of the environmental program are linked to the project's major decision points.
- Investigations to describe environmental impacts that are not critical to project planning are deferred until a decision has been made to proceed with the project i.e., to produce a 'bankable' feasibility study and prepare a DPEMP.

The proposed environmental work program therefore involves two phases:

- Project planning phase (which generally corresponds to the prefeasibility study, possibly extending into the early stages of the feasibility stage):
  - *Long-elapsed time investigations* for those variables where the range in natural fluctuations is unlikely to be captured on a seasonal basis and longer-term measurements are required.
  - *Short-elapsed time investigations* for those studies that can be adequately completed within a short period of time, some of which will need to be completed at an early stage.
- Environmental impact assessment and management strategy phase (which generally corresponds to the latter stages of the feasibility study).

Of the two phases, we recommend that the long-elapsed time environmental investigations of the project planning phase should start as soon as possible. The short-elapsed time environmental investigations can be undertaken in the period immediately before the decision to proceed to a feasibility study. Once that decision is taken, the preparation of the DPEMP is likely to be completed within six months.

Environmental baseline investigations normally follow the decision to proceed with the project and are not initiated until the relevant government approvals have been obtained. The purpose of the environmental baseline is to characterise the predevelopment conditions and thus provide a statistically- and scientifically-valid basis for comparison with future conditions. This ensures that any future allegation of unforeseen environmental damage caused by the project can be addressed by reference to the baseline.

This section outlines the scope of the proposed environmental investigations that are envisaged for both phases of work. More detail is provided for those investigations required during the project planning phase than the impact assessment phase because the latter is somewhat speculative in that the final scope will depend on the concepts that are formulated during the first phase.

5.2 Project Planning Phase - Long-elapsed and Short-elapsed Time Investigations

5.2.1 Hydrological/Suspended Sediment Investigations

Objectives

- To provide a suitable hydrological database to design the mine's water supply, mine pit water diversion and drainage structures and to enable the confident prediction of sediment transport and deposition in the downstream drainage.
- To establish the range of background (pre-mining) suspended sediment concentrations in the downstream drainage[6].
- To establish the background riverine sediment load passing through the mine area.

Long-elapsed time investigations

The initial site visit determined the existence of a stream gauging station in the immediate project area at Main Creek, and the existence of a second gauging station on the Savage River below its confluence with Main Creek is known. We propose that GTR investigate with HEC and/or ABM:

[6] In most rivers the suspended sediment concentration is related to river discharge and increases as the discharge increases. The quantification of this relationship is essential for the prediction of downriver environmental impact and will allow utilisation of case study information on the effects of mining on downriver aquatic biota that has been built up both in the Savage River and elsewhere.

- Obtaining access to the stream discharge data from these two stations.
- Installing, monitoring and providing routine maintenance of rising-stage samplers at these gauging stations to establish the range of background total suspended sediment (TSS) concentrations.
- Obtaining access to existing TSS data for Main Creek and Savage River and any ongoing data collection program.

Determining existing background TSS concentrations and loads is crucial given the past and potential inputs from the Savage River Mine site.

Short-elapsed time investigations

The following supplemental investigations are proposed:

- Calibration of the rising-stage sampler results by undertaking a series of intensive campaigns using depth-integrated suspended sediment sampling.

5.2.2 Meteorological Investigations

Objective

- To provide a suitable meteorological database to design those parts of the mine and refinery requiring knowledge of meteorological variables.
- To provide rainfall data which can be used in conjunction with stream discharge data for impact assessment.

Long-elapsed time investigations

- Obtain access to the current meteorological station located at Savage River, and to other meteorological stations which may be relevant to the site of the refinery once this is known.

5.2.3 Characterisation of Waste Material/Impacts on Receiving Waters

Objectives

- To characterise the ore, waste rock and tailing and define any potential for acid generation and dissolution of any contained metals.
- To assess the suitability of the waste material as a substrate for revegetation.
- To make an assessment of the potential for acid rock drainage (ARD) and/or drainage with elevated metal contents for input into waste disposal design and management.
- If necessary, to evaluate pre-emption or mitigation and control measures.
- To determine the impacts on receiving water quality relative to Tasmanian and Australian water quality standards and guidelines.

Long-elapsed time investigations

The following investigations are proposed:

- Routine analysis of drill core (both ore and waste rock) for total sulfur and total carbon as an initial assessment of the potential for acid generation.
- Conduct a laboratory program (kinetic testwork) on representative rock types. The various rock types will be watered and the leachate routinely sampled and analysed for evidence of sulfide oxidation and metal dissolution.

Short-elapsed time investigations

The following supplemental investigations are proposed:

- Undertake a detailed program to fully assess the variability and nature of waste rock and tailing and its potential to release dissolved metals (static testwork for different rock types, etc).
- Once representative samples have been taken, the testwork has been completed and the results are available, the potential for acid formation and dissolution of any contained metals in the pit, the waste dumps and the tailing will be assessed and implications for mine design, management and control will be addressed.
- Undertake mixing tests to assess the mobility of key contaminants after discharge into the receiving waters. The latter will involve mixing representative samples of material which will potentially report to the receiving waters with local stream water at various dilution ratios/stirring periods and determining both filtered and unfiltered concentrations of key water quality variables. Dissolved oxygen, pH, temperature, conductivity will also be determined.

5.2.4 Environmental Characterisation

Objectives

- To characterise key environmental quality indicators in the water, soil, sediment and biota prior to project development.

Long-elapsed time investigations

The following investigations are proposed:

- Obtain and review existing water quality data from ABM and/or DELM for Main Creek and Savage River.
- Depending on the results of this review, undertake a water quality monitoring program involving an intensive, initial survey at selected sites on Main Creek

and Savage River, taking into account variations in flow, i.e. flood sampling[7], followed by periodic sampling at the same sites.

- Collect samples of soil, sediment and aquatic biota. The data will be used to characterise these environmental compartments in terms of relevant variables (e.g. trace metals) and will form the basis of a baseline dataset.

Short-elapsed time investigations

The following supplemental investigations are proposed:

- Additional collection of samples of water, soil, sediment and aquatic biota to expand the baseline dataset to give a statistically- and scientifically-valid dataset.

5.3 Project Planning Phase - Short-elapsed Time Investigations Only

5.3.1 Sediment Transport Investigations

Objective

- To predict mine-derived bed sedimentation in the downstream drainage and the nature and extent of its impact with respect to associated beneficial uses.

Short-elapsed time investigations

The following preliminary investigations are proposed:

- Hydraulic assessment using the historical hydrological data collected by the HEC and determination of the channel characteristics and variation in longitudinal slope downriver.
- Sediment sizing assessment by analysis of existing river bed sediment samples and estimation of mine-derived sediment sizing and abrasion.
- Identification of sources and pathways of mine-derived sediment entering the receiving waters.
- Estimation of quantities and timing of mine-derived sediment entering the receiving waters.
- Estimation of sediment transport capacity in the receiving waters.

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[7] Water quality in tropical river systems often deteriorates with increasing flow. Sampling of high-flow events is therefore crucial in terms of characterising existing conditions and determining the total loads of suspended solids and associated trace metals moving downstream.

- Prediction of the likely increment in suspended sediment concentrations during both construction and operations (by numerical modelling and also comparison to actual data for other river systems).
- Prediction of areas of likely riverbed sedimentation and estimate rates of aggradation (by numerical modelling and also comparison to actual data for other river systems).
- Estimation of the long-term behaviour and fate of project-derived sedimentation in the river system.

5.3.2 Aquatic Biota Investigations

Objectives

- To identify species of conservation and/or recreational importance in the receiving waters.
- To characterise the aquatic ecosystems in the receiving waters.

Short-elapsed time investigations

The following investigations are proposed:

- Identify and review local information sources e.g. people living at Corinna, to determine the known occurrence and abundance of aquatic fauna.
- Undertake netting and/or electro-fishing to determine the range of species in the receiving waters.
- If appropriate, employ the AusRivAS[8] stream assessment procedures .

5.3.3 Terrestrial Conservation Values

Objectives

- To determine whether the project area contains any flora and fauna species or other features of special conservation significance.

Short-elapsed time investigations

The following investigations are proposed (using local biologists/conservationists if appropriate):

- Review existing information, including discussions with DELM, Forestry Tasmania and other relevant bodies, to ascertain the existing flora and fauna in the project area and other features of potential significance, e.g. karst caves.

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[8] AusRivAS is the Australian Rivers Assessment System which has only recently been developed to assess river health and involves the examination of aquatic macroinvertebrate fauna.

- Depending on the results of this review, undertake surveys to examine and record plant species and other features that occur in areas to be disturbed.
- If necessary, evaluate pre-emption or mitigation and control measures.

5.3.4 Archaeological Investigations

Objectives

- To determine whether the project area contains any sites of archaeological significance or of cultural significance.

Short-elapsed time investigations

We propose that the following be undertaken:

- Consult with relevant government authorities and examine the relevant literature to identify the location of any known archaeological sites in the project area.
- If necessary, carry out archaeological surveys of the project area and identify any archaeological sites and describe their significance and implications for siting.

5.3.5 Atmospheric/Noise Investigations

Objectives

- To determine the likely impacts due to air emissions and noise associated with the project.

Short-elapsed time investigations

We propose that the following be undertaken:

- Prepare an air dispersion model using an appropriate gaussian plume model and meteorological data file.
- Assess the potential for environmental nuisance or harm to be caused, particularly in relation to dust, odour and acid gases.
- If necessary, evaluate pre-emption or mitigation and control measures.

5.3.6 Socio-economic Investigations

Objectives

- To determine ways to maximise the likely positive and minimise the negative socio-economic effects resulting from the development of the project.

Short-elapsed time investigations

We propose that the following be undertaken with particular reference to:

- Employment
- Income

- Cost of living
- Housing
- Community facilities

- Identify the existing education and skill levels, employment and income levels of potentially affected populations and relate these to likely GTR recruitment, labour training requirements and payroll.
- Identify local economies, cost structures and standards of living of potentially affected populations.
- Identify existing government services such as health, education, etc. in potentially affected populations.
- Determine potentially affected peoples' expectations for employment, training, business development, infrastructure and services both with and without the project.
- Recommend practical and achievable measures to enhance the positive and minimise the negative socio-economic effects of the project.

5.4 Reporting

We envisage that environmental reporting during the project planning phase will take the form of a series of investigation reports. Assuming that the project proceeds to the next phase, we then envisage that individual investigation reports will ultimately become supporting documents (appendices) to the DPEMP. Should GTR decide at any point not to proceed with the project, a report would be prepared summarising all investigations and results up to that point in time.

5.5 Environmental Impact Assessment and Management Plan

Experience of mining projects in similar environments shows that the environmental effects of the construction phase are important and, in some cases, are even more severe than during the operations phase. Therefore, we propose to structure the environmental impact assessment and management plan formulation so that appropriate emphasis is given to both the construction and operations effects.

5.5.1 Land Impacts and Management

In the mine area, any siting constraints identified during the project planning phase will be highlighted together with implications for the project's general arrangement. Proposed mitigation and management measures to reduce the project's effects on land and particularly relevant conservation or archaeological values will be identified. The extent of the project's unavoidable land alienation and the resulting implications will be identified. The suitability of rehabilitated surfaces for revegetation and other possible end uses will also be described.

5.5.2 Stream Impacts and Management

Changes to stream flows and the local drainage pattern, such as diversion channels, will be described. Implications of these hydrological changes with respect to existing downstream aquatic biota will be described.

Localised bed sedimentation and high concentrations of suspended sediment in the downstream drainage are generally associated with mining developments. Therefore, we suggest that appropriate emphasis be placed on integrating mitigation and management measures and controls into the project design and operation to minimise these effects. These measures and their likely degree of success will be described.

Notwithstanding controls to minimise sediment generation, the transport of mine-derived sediment into and along the stream system will be simulated and predictions made on the incremental sediment loading to the river and its likely behaviour and fate in terms of bed sedimentation and timetable for its ultimate transport downriver.

The potential for acid rock drainage will determine chemical effects on downstream water quality and any toxicity to aquatic biota; however, elevated concentrations of suspended sediment in the downstream drainage are expected to be the principal cause of effects on aquatic biota. The combined physical and chemical effects on identified downstream environmental values will be estimated.

5.5.3 Air Quality Impacts and Management

The air quality impact associated with mining is expected to be small and not significant either locally or regionally. Significant impacts may be associated with the refinery, hence significant management measures may be required and these will be discussed.

5.5.4 Socio-economic Impacts

The socio-economic effects of the project will be described in terms of the positive and negative effects. Components to be covered will include:

- Population, settlement and migration.
- Existing transportation, education and health.
- Opportunities for employment and business development.
- Workforce composition and training.
- Royalty and compensation payments.
- Local, regional and national issues.

5.5.5 Rehabilitation

The DPEMP will address the integration of a possible rehabilitation concept with the mine plan.

5.6 Government Liaison and Approval Process

Approval of the project is likely to be facilitated by the establishment of an effective working relationship with relevant government agencies and local community groups.

We therefore recommend that GTR establish and maintain open communications with government agencies and relevant non-government organisations (NGOs) and community groups on the environmental aspects of the project. In practice, this means identifying and maintaining contact with key personnel, progressively reviewing results of ongoing investigations, holding regular liaison meetings and agreeing to changes in the scope of work should the project's environmental concepts change.

6. Schedule

The DPEMP for the mine and the refinery would be developed as a single document which would address all project components. The following provides an indication of the overall Environmental Program Schedule culminating in issuing the Land Use Permit(s):

• Commencement of program	Day 1, Month 1, Year 1
• Briefs prepared for DPEMP studies	Day 15, Month 1, Year 1
• Government/NGO/comm. liaison commences	Day 30, Month 1, Year 1
• DPEMP studies commence	Day 30, Month 2, Year 1
• Short-term DPEMP studies finish	Day 30, Month 6, Year 1
• Submission of first draft DPEMP to GTR	Day 1, Month 9, Year 1
• GTR review of draft DPEMP complete	Day 21, Month 9, Year 1
• Finalisation of DPEMP complete	Day 14, Month 10, Year 1
• DPEMP submitted	Day 17, Month 10, Year 1
• DELM's report finalised	Day 30, Month 11, Year 1
• Land Use Permit(s) issues	Day 21, Month 12, Year 1

This schedule is based on our best estimate of the likely time required to complete the relevant studies and obtain approval of the DPEMP.

A key component of the process is the design and implementation of an effective consultation process, as described previously. This is an ongoing and continual process. However, the intensity of the process is likely to vary, depending on the particular stage of the project and initial responses. Extensive consultation is likely to be required at the following stages:

- Initiation of the environmental program.
- Throughout the preparation of the DPEMP, but particularly as results from the studies become available.
- Finalisation of the DPEMP.

It should be noted that provision of ongoing advice and support (which includes ensuring that all commitments contained in the DPEMP are implemented) will occur as required during construction and operation.

7. Cost Estimate

This section provides indicative cost estimates for preparation of the DPEMP and the public consultation process. Costs are itemised for the various studies described in Section 5.

All costs are given in Australian dollars.

DPEMP - Technical Studies (total = $202,500)

- Hydrological/Suspended Sediment Investigations ($7,500)
- Meteorological Investigations ($2,500)
- Characterisation of Waste Material/Impacts on Receiving Waters ($40,000)
- Environmental Characterisation ($35,000)
- Sediment Transport Investigations ($25,000)
- Aquatic Biota Investigations ($25,000)
- Terrestrial Conservation Values ($20,000)
- Archaeological Investigations ($10,000)
- Atmospheric/Noise Investigations ($12,500)
- Socio-economic Investigations ($5,000)
- Technical Study Reports ($20,000)

DPEMP - Preparation and Community Consultation (total = $70,000)

- Report Preparation ($50,000)
- Consultation ($20,000)

Project Management (total = $30,000)

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