KALGOORLIE TAILINGS RETREATMENT PROJECT
KALGOORLIE, WESTERN AUSTRALIA

ANGLO AMERICAN PACIFIC LTD

Report and Recommendations
of the
Environmental Protection Authority

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i SUMMARY AND RECOMMENDATIONS

Anglo American Pacific Ltd (AAP) proposes to develop a project which would reprocess old gold tailing dumps located in the Golden Mile, Kalgoorlie. AAP plans to treat 32.5 million tonnes which may increase to 57 million tonnes if additional dumps are incorporated.

The project would mine the old tailings dumps using high pressure water jets from monitor guns. The slurry of tailings would be pumped from the monitor station the to plant site, and then passed through a carbon-leach/carbon in pulp circuit. The loaded carbon would be transferred to a gold eluation circuit and the gold bullion would be recovered by electrolytic deposition. The retreated tailings would be disposed of in a new tailings storage. The tailings storage approximately 300 ha in area would be located in a sandalwood Reserve vested in the Department of Conservation and Land Management. The project would treat 12 000 tonnes per day for up to fourteen years. It would employ sixty-seven people on a 24 hours a day, seven days a week basis.

The existing old tailing dumps in the Golden mile of Kalgoorlie are the major dust source for the Kalgoorlie Boulder area. The removal of the dumps would significantly improve the air quality of the district. The Authority notes that the project would cause the loss of approximately 10 percent of the Lakeside Timber Reserve but has decided that this loss would be balanced by the benefit to the community of improved air quality, and if AAP ensure that an equivalent area is secured and managed as greenbelt to protect the environmental amenity of the area.

Accordingly the Authority has concluded that the proposal is environmentally acceptable and has made the following recommendations:

RECOMMENDATION 1

The Environmental Protection Authority has concluded that the proposal is environmentally acceptable and recommends that it could proceed subject to the Authority's Recommendations in this Report and the proponent abiding by the environmental commitments in the Public Environmental Report (see Appendix A) including:

- **rehabilitation of tailing storage area and mined tailing dumps; and**
- **monitoring of water quality and dust levels associated with the project.**

RECOMMENDATION 2

The Environmental Protection Authority recommends that the Department of Conservation and Land Management be consulted prior to clearing of the tailings storage site particularly regarding the salvaging of sandalwood.

RECOMMENDATION 3

The Environmental Protection Authority recommends that Anglo American Pacific Ltd should:

- **prior to commissioning ensure the replacement of an area of greenbelt, equivalent to that which would be removed by the proposal, to maintain the environmental amenity in the vicinity of Kalgoorlie and Boulder; and**
- **ensure that the replacement area has appropriate security of tenure, purpose and management.**

1. INTRODUCTION

Anglo American Pacific Limited (AAP) proposes to reprocess gold tailings from tailings dumps located in the Golden Mile, south east of Boulder (see Figure 1). There are 32.5 million tonnes of tailings currently available and possibly 57 million tonnes would be finally retreated. The tailings would be mined using water jets and would be processed through a carbon each/carbon in pulp process plant.

The Environmental Protection Authority decided to assess the proposed preparation of a Public Environmental Report (PER). The PER was released for a period for public review which concluded on 26 March 1988.

2. PROJECT DESCRIPTION

2.1 MINING

The proposed mining technique is hydraulic mining, using high pressure monitor guns. Reclamation will operate on a 24 hour day, 7 days a week basis. The mining of each dump will continue until the ground surface is reached. After mining with the high pressure monitor guns some residual slimes will remain. These will be removed by mechanical means (eg scrapers, loaders and trucks). It is proposed then to rip and contour the site, determine the soil nutrients requirements and carry out a soil revitalisation programme. The surface would be armoured with 35 to 40 millimetres/layer of erosion resistant cover. Revegetation would be attempted.

2.2 ORE PROCESSING

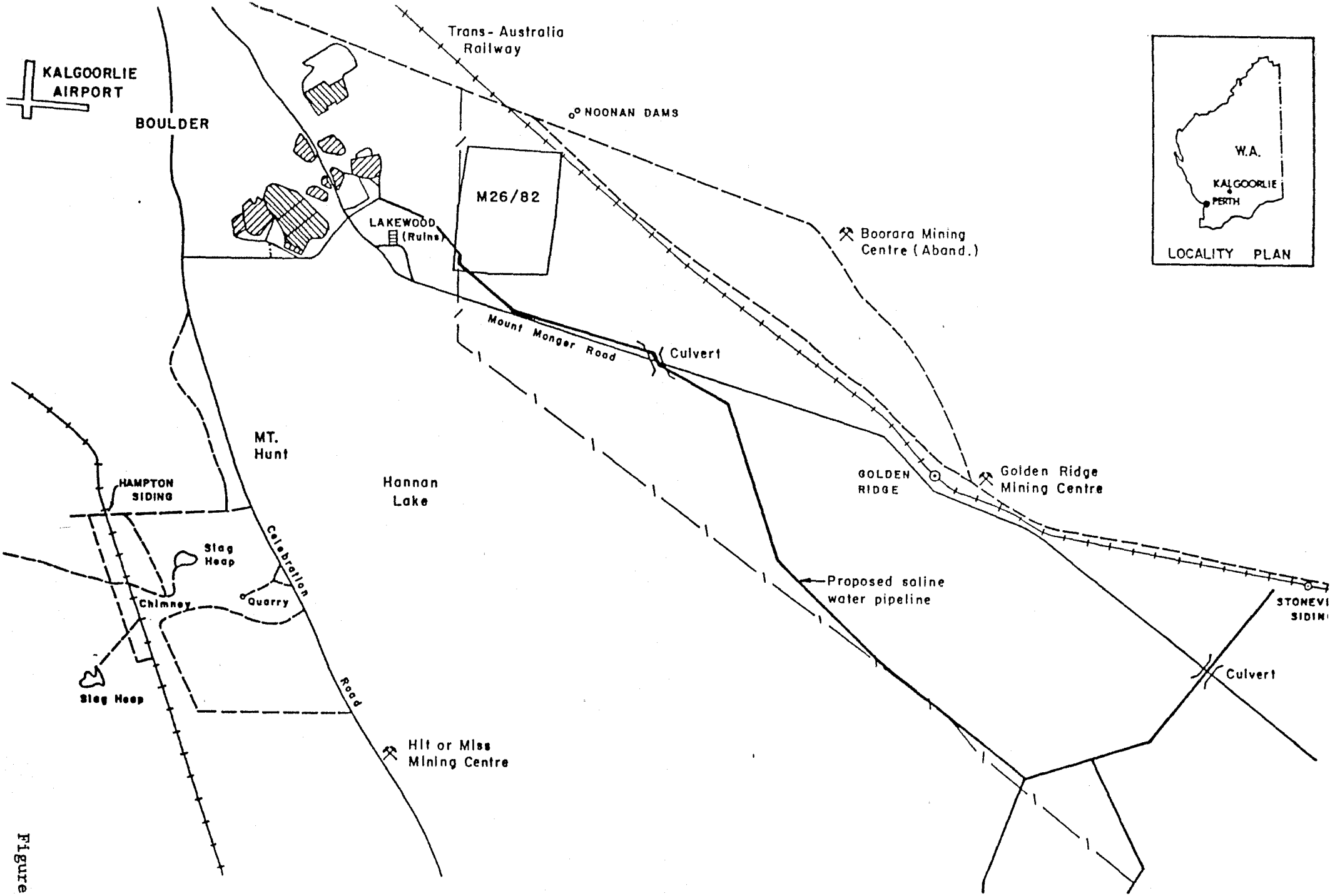
After slurrying of the tailings by the high pressure water jets of the monitor guns, the tailings will flow by gravity to the monitor pump station where a coarse screening at 3 millimetres will remove the oversize particles and trash material. All oversize and trash material will be temporarily stockpiled and then trucked to the new tailings storage site. The screened slurry will be pumped to the central plant.

At the central plant the reclaimed tailings will be thickened and rescreened to remove all material greater than 600 micrometres in diameter. The undersize material will then gravity flow to the first of six leach tanks. The oversize material will gravitate to the tailings discharge. Gold recovery will be achieved by the carbon absorption process in six mechanically agitated vessels. Loaded carbon containing gold will be removed regularly from the carbon-in-pulp vessels and transferred to a gold elution circuit. The final gold recovery circuit will operate using the patented Anglo American Research Laboratories Elution Procedure and gold bullion will be removed via electrolytic deposition from the resultant eluate.

All waste products would be returned to various parts of the circuit and ultimately disposed of to the new tailings storage.

2.3 TAILINGS DISPOSAL

The project would generate up to 12 000 tonnes of tailings per day. The tailings would be virtually unchanged in character from the original tailings, because there would not be a grinding circuit in the plant. There would be, however, an increase in salt levels in the tailings due to the hypersaline borewater used in the reclamation.



PROJECT LAYOUT
(1 : 100 000)

Figure 1.

The tailings would be pumped from the plant to the storage in a slurry form. Once deposited into the storage the tailings should be relatively stable against wind erosion, due to the moisture in the tailings and salt crusting.

The cyanide content of the tailing solution as it enters the tailing storage would be expected to be 50 to 100 micrograms per litre (mg/l) cyanide. The cyanide would be subjected to degradation and complexation and it would be expected that final cyanide levels would be below 1 mg/l.

The proposed tailings storage would occupy an area of approximately 290 ha, the highest point 26 metres above the original ground level. A single storage area with a rectangular shape is envisaged. The capacity of the storage would be increased over the lifetime of the project by raising the outer embankments using excavated coarse tailings. The initial embankments would be made of earth obtained from within the storage area. The downstream embankment would have slopes of 3 to 1 and the upstream 2 to 1. There would be a 5 metre berm at each lift producing an overall slope of 4 to 1.

Seepage from the tailings storage should be minimal. The foundation would comprise of hard clay gravels of low permeability. The deposited tailings would be allowed to air dry to achieve high density and low permeability.

The storage would maintain a freeboard sufficient to contain any rainfall, even assuming that the plant is not drawing water.

The proponent has indicated that the preferred site for the tailing storage and plant site is on ML 26/82. This mining lease is contained in a sandalwood Reserve vested with Department of Conservation and Land Management. The reserve is 3 500 HA in size and the project would require approximately 10 percent of this area.

2.4 INFRASTRUCTURE

2.4.1 WATER

The project at full production would require 12 000 kilolitres per day. This water would be mined from a paleodrainage channel. The water quality would be approximately as follows:

TDS 90 000 to 120 000 mg/l
pH 3.5 to 8.0

The water supply borefield is expected to consist of 21 production bores. The bores would be located approximately at 1.3 kilometre intervals. The pipeline from the borefield to the storage dam at the plant site would be buried at least 300 millimetres deep. Isolation valves and scours valves and sumps would be installed along the pipeline route.

Monitor bores would be constructed to progressively monitor the ground water levels during the operation of the borefield.

It is anticipated that 15 to 40 percent of the total water pumped to the tailings storage will be recovered to recirculate through the plant. The remaining quantity of water would either be trapped in the tailing or lost to evaporation.

2.4.2 POWER SYSTEM

Power would be received at the plant site via a 33kV line from a SEC WA transmission line. The plant design requires a total installed power of 7.5 MW with normal operating loads of 3.8 MW.

2.4.3 SLURRY PIPELINE

The slurry pipeline from the monitor station to the plant site and from the plant site to the tailings storage would be located above ground, within a bunded channel to contain spillage.

2.4.4 ROADS

A new road would be constructed from the old tailings dumps to the plant site. Access roads would be constructed as necessary for the life of each monitor station.

3. EXISTING ENVIRONMENT

3.1 REGIONAL SETTING

The project will be located in the Shire of Boulder. A major feature of the area is the group of large tailing dumps in the Lakewood area, which have been a major source of dust in the Kalgoorlie and Boulder town areas.

3.2 GEOLOGY

The project area lies within the Archean Yilgarn Block. The basement rocks of the Yilgarn system in the project area consist of ultramafic to mafic intrusives and extrusives, acid volcanics, clastic and chemical sediments. The area is highly prospective for gold exploration. Condemation drilling has been undertaken over the proposed tailings disposed site. The results of this work indicated that there is no significant gold mineralization at shallow depths.

3.3 SOILS

The major soil types of the existing and proposed tailing sites and environs are red earths with limestone nodules and alkaline red earths.

The soils of the tailings disposed area consist of red/brown loams and sandy dry loams. At depths of 200 to 300 millimetres there is a gradual increase in gravel and clay components. Between 0.2 and 0.5 metres of soil is suitable to stockpile as topsoil.

3.4 GEOMORPHOLOGY AND HYDROLOGY

The proposed plant/tailings disposal area is situated on an alluvial-colluvial slope, underlain by deeply weathered basement rock. The topography is relatively flat, with a gentle south-westerly slope. The site drains to the south-west towards Hannan Lake, via sheet flow and by a series of indistinct shallow channels which cross the site. The drainage system has a catchment of approximately 10 kilometres upstream from the site. The presence of the railway embankment has influenced the downstream drainage pattern by concentrating sheet flow into discrete channels. Estimated peak discharged into the tailings disposal area is 49 cubic metres per second with a return period every 20 years.

Local infiltration of runoff generates some subsurface flow at depths of 1 to 2 meters. Deeper percolation through underlying sediments is minimal. Runoff, at present flows to the Hannan Lake depression and would continue to do so after the construction of the tailings storage and plant site. The Hannan Lake environment is too saline to be considered a suitable water resource.

The regional groundwater flow generally follows the same broad drainage pattern as the surface water flow. The aquifers comprising the groundwater system in the vicinity of the project site include:

. Cainozoic alluvial sands/gravels; and

. Tertiary paleochannel sands.

Groundwater resources in the area are also considered to be too saline to be suitable for portable or stock watering purposes.

3.5 AIR QUALITY AND DUST

Dust has been a significant problem for a number of years in the Kalgoorlie Boulder district. The dust levels are highest in the summer months when evaporation is highest and the dry winds from the south and south-east are predominant. The old tailings dumps have been identified as the major source of dust pollution in the district.

Attempts to reduce this major source of dust by stabilizing the dumps have met with various problems, such as:

. high salinity of dump material;

. the steep side slopes of the dumps;

. exposure to winds;

. unavailability or cost of freshwater for irrigation; and

. the high cost of rock armouring programmes.

3.6 FLORA

The tailings storage and plant site vegetation is dominated by woodland with a complex understorey. The southern part of the area is saline flats surrounding Hannan Lake. The area between existing tailings dumps and the proposed plant site is either broad drainage flats, often saline or severley degraded erosion zones of the dumps supporting little vegetation.

The woodland zone is dominated by Eucalypts with scattered occurrences of Casuarina, Sandalwood and Pittosporum. Understorey species include Eremophilas, Acacia, Saltbush, Bluebush and Spinifex. The drainage shrublands are of several kinds depending on the drainage influence:

. Broombush type;

. Chenopod type; and

. Succulent type.

The broombush shrublands include species such as Eremophilas, Cassia and Acacia, the Chenopod shrubland includes saltbush and bluebush and the succulent shrublands has a restricted species list including saltbush, bluebush and Frankenia.

3.7 FAUNA

Fauna habitats are closely aligned with the geomorphological - vegetation zone. A field study conducted in 1987 recorded 20 species of bird, 3 native and 5 introduced mammals and 3 reptiles. Literature searches suggest that the area covered could support 80 bird, 20 native and 7 introduced mammals, 4 amphibians and 54 reptile species. None of the species sighted in the field survey is endemic to the region. Two birds and one reptile are gazetted as rare or otherwise in need of protection.

3.8 ABORIGINAL SITES

A preliminary investigation for Aboriginal sites was carried out. No significant artifacts or structures were noted. There are no registered sites within the study area.

4. ENVIRONMENTAL IMPACTS AND MANAGEMENT

Anglo American Pacific Ltd would appoint a project rehabilitation/environmental officer at the commencement of the operations. The rehabilitation philosophy with funds for significant research includes the following principles:

. final landforms should be stable;

. final landforms should be non-toxic; and

. final landforms should conform to surrounding natural landforms.

4.1 DUST

Dust generation is not anticipated to be a significant impact of the project. The mining operation involves reclamation by water jets and this would not produce large quantity of dust. The tailings would be deposited wet and would not generate large quantities of dust. Some dust generation would occur during construction phase due to the clearing and stripping of the tailing storage and plant site. Stripping operation would avoid periods of excessively high winds to minimize dust generation. The potential for dust generation from the tailings storage batters would be minimized by progressive rehabilitation of the tailing storage site.

It is significant that the project proposes to remove a significant source of dust for the Goldfield district. 274 HA or about 80 percent of the exposed area of the tailing dump to the south-east of the Boulder township could be removed.

Anglo American Pacific would conduct a dust monitoring programme including one year of baseline data.

4.2 POWER AND WATER PIPELINE CORRIDOR

Disturbance to soils and vegetation during construction would be minimized. Scour sumps would be placed along the water supply line to allow periodic

flushing. These sumps would be kept away from mature trees to avoid damage to vegetation. Soils disturbed by the pipe laying operation would be replaced and raked to encourage shrub growth.

On decommissioning, above ground installation will be removed and the area rehabilitated.

4.3 MINED TAILING DUMPS

The existing tailings dumps are the major dust source for Kalgoorlie and Boulder. The mining of the dumps will remove them as a dust source. It is intended that area of the mined tailing dumps would be progressively rehabilitated. However, this would require the permission of the underlying tenement holders.

Following the removal of each dump, the surface soil would be analysed to determine nutrient requirements. The ground surface would have a low slope and would be deep cross ripped at 1 metre spacing. The surface would then be armoured with a 35 to 40 metre layer of erosion resistant cover such as nickel slag. The area would be left to leach for 1 to 2 years. Revegetation of the area will be carried out on a trial basis with a number of salt tolerant species.

After the leaching period, further material such as waste rock will be spread across the area to provide suitable plant rooting medium and to further reduce the potential for wind erosion.

In the event that revegetation is unsuccessful the area will be covered with waste rock.

4.4 TAILINGS STORAGE

The tailings storage would be progressively rehabilitated. This would include the creation of a structurally stable batters with a maximum angle of 1:4 which would be covered 1 metre of waste rock followed by a layer of top soil into which machine-mulched vegetation has been incorporated.

Progressive revegetation would be attempted on a trial basis. Revegetation would incorporate direct seeding or planting of native species with the application of phosphate fertilizer. Should no species be found with sufficiently high salt tolerance, then the surfaces will be armoured with waste rock.

Rehabilitation of the top surface of the storage would not be possible until completion of the project. The strategy would be similar to that for the mined tailings dump.

The tailing storage would contain cyanide and be highly saline, because of this a water monitor of programme would be conducted. Monitoring bores in selected locations downstream of the storage would be sampled and analysed on a regular basis.

The monitoring would include one year of baseline measurement.

Bird activity in the tailings storage would be recorded and reported.

5. PUBLIC SUBMISSIONS

The Environmental Protection Authority received several submissions on the Kalgoorlie Tailing Retreatment Project (see Appendix B). The major environmental issues addressed in the submission were:

. site selection for tailing storage and the plant;

. effects of ruptures in both the saline pipeline and the slurry pipeline;

. dust levels associated with the project; and

. operation and monitoring of the tailing storage area.

The proponent has addressed the issues raised in the submissions in Appendix C.

6. CONCLUSION

The EPA has reviewed the Kalgoorlie Tailings Retreatment Project and considers that the loss of about 10 percent of the Sandalwood Reserve was the key environmental issue.

However, this was balanced against the improvements in air quality by reduced dust for Kalgoorlie - Boulder which would occur if the project went ahead with the new tailings' dumps stabilized.

Accordingly, the EPA has recommended that Anglo American Pacific Ltd protect the environmental amenity of the Kalgoorlie - Boulder area by equivalent ensuring that a secure and managed equivalent area of greenbelt is replaced in the vicinity of the project.

If this was done and the Company implements its commitments for environmental management, the EPA considered the proposal environmentally acceptable.

RECOMMENDATION 1

The Environmental Protection Authority has concluded that the proposal is environmentally acceptable and recommends that it could proceed subject to the Authority's Recommendations in this Report and the proponent abiding by the environmental commitments in the Public Environmental Report (see Appendix A) including:

. rehabilitation of tailings storage area and mined tailing dumps; and

. monitoring of water quality and dust levels associated with the project.

The Authority has noted that there would be a loss of approximately 300 HA of sandalwood reserve for the storage of retreated tailings. The project however, would result in the removal of the major dust source in the Kalgoorlie Boulder area and this would lead to a major improvement of air quality in the area.

RECOMMENDATION 2

The Environmental Protection Authority recommends that the Department of Conservation and Land Management be consulted prior to the clearing of the tailings storage site particularly regarding the salvaging of Sandalwood.

The Environmental Protection Authority is concerned about maintaining the environmental amenity in the vicinity of Kalgoorlie and Boulder.

RECOMMENDATION 3

The Environmental Protection Authority recommends that Anglo American Pacific Ltd:

- **should prior to commissioning ensure the replacement of an area of greenbelt equivalent to that which would be removed by the proposal, to maintain the environmental amenity in the vicinity of Kalgoorlie and Boulder; and**

- **ensure that the replacement area has appropriate security of tenure, purpose and management.**

APPENDIX A

MAJOR ENVIRONMENTAL COMMITMENTS

1. General

- Appoint a rehabilitation/environmental officer responsible for all monitoring programmes, revegetation trials and liaison with CALM.

2. Mined Tailings Dumps

- Restore about 300 ha, staged to follow monitor station moves.

- Restoration Programme (to be carried out only with the permission of all underlying tenement holders):

  (1) Characterize soil, cross-rip and cover with 35 - 40 mm nickel slag, or equivalent.
  (2) Leave to leach for at least two years.
  (3) Construct wind rows of planting medium and conduct revegetation trials.
  (4) In the event that revegetation is unsuccessful, cover with waste rock or equivalent, as dust and erosion protection.

3. New Tailings Storage

- Salvage timber and stockpile topsoil.

- Construct an underdrainage system to return seepage to the plant.

- Maintain freeboard at all times to contain a Probable Maximum Precipitation of 860 mm, plus wave action.

- Progressively flatten the outer embankments and cover with at least 1 m of waste rock or equivalent to create a final slope of 1:4, or flatter. Cover with a layer of topsoil and mulch, and conduct revegetation trials.

- Maintain a maximum slope length of 30 m by constructing 5 m berms on the outer slope.

- In the event that revegetation on the outer embankments is unsuccessful, armour with further waste rock or equivalent, as erosion protection.

- Rehabilitate the top surface upon decommissioning by cross-ripping and covering with nickel slag or equivalent to minimize dust and enhance leaching. The surface will then be either revegetated or armoured, depending on the results of revegetation trials.

- Monitor the tailings storage throughout the project life, and commission independent and qualified consultants to review the following data recorded by the proponent to reassess the operational procedures:

  (1) Pressure heads in embankments and foundation.
  (2) Settlement of embankments.
  (3) Return water quantity and quality.
  (4) Strength of tailings in embankments.
  (5) Survey of embankment and beach levels.
  (6) Dust levels, including one year of baseline measurement.
  (7) Groundwater levels and quality in bores downstream of storage, including one year of baseline measurement.
  (8) Bird activity.

4. Water Supply

- Maximize return water from tailings storage.
- Bury water supply pipelines.
- Minimize clearing of pipeline track by following existing easements and cleared lines as far as possible.
- Divert pipeline around large trees, wherever possible.
- Replace and rake soil to promote natural regrowth following pipeline installation.
- Construct sumps to contain water discharged during drilling and testing, and at scour valves.
- Design abstraction rates to minimize the effect on adjacent groundwater users.
- Monitor and assess the performance of the aquifer throughout the project life.

5. Social

- Provide employment for about 67 persons.
- Provide additional housing.

6. Project Closure

- The rehabilitation programme will be completed and the project sites will be cleared of debris when the project closes.

APPENDIX B

SUMMARY AND REVIEW OF SUBMISSIONS

Several major environmental issues were addressed in the submission.

1. SITE SELECTION

A number of submissions were concerned about the location of the tailing disposal area in a timber reserve, and that the case for dismisal of several sites was weak.

Site 3 was eliminated due to proximity to town and dusting. Dusting is unlikely to occur due to the salinity of the material and as such further review of this site is required.

Site 6 also appears to be suitable. The only consideration being financial.

2. TAILINGS DISPOSAL

Several submissions expressed concern about the construction of the tailings dam.

There was a suggestion that the dam could be constructed in four cells. This would allow rehabilitation trials to begin earlier. Compaction of the tailing dam floor could also be necessary. There was some concern expressed over the flood diversion works.

Several submissions indicated that a groundwater monitoring programme would be required as well as monitoring of cyanide levels in the tailing dam.

One submission indicated that the whole area should be fenced, not just dangerous area.

Several submissions suggested compensation should be paid for the timber reserve and new areas acquired.

Several submissions suggested that CALM should approve plans for clearing the disposal area and for salvage of the sandlewood.

3. DUST

Dust monitoring on and off-site was suggested by several submissions.

A number of submissions were concerned with the current tailings dump. It was suggested that tailings dumps not to be treated for a number of years should be stabilized.

Several submissions expressed concern over dust at the new tailing site.

4. SALINE WATER AND SLURRY PIPELINE

A number of submissions expressed concern over possible rupture in both the saline water pipeline and the slurry pipeline. What would be the cleanup procedure and how often would the pipelines be checked for leaks?

5. WATER SUPPLY

The report indicated the drawn down in water level but did not indicate what level the water level is currently

6. TRANSPORT

One submission wished to know whether Anglo America was going to upgrade the roads it was using.

Another submission expressed concern about the amount of cyanide being transported through the Kalgoorlie and Boulder and what were contingencies plans for spillages.

7. NOISE

One submission enquired about the noise levels associated with the project.

APPENDIX C

ANGLO AMERICAN PACIFIC LTD
2034/1
APRIL 1988

KALGOORLIE TAILINGS RETREATMENT PROJECT PUBLIC ENVIRONMENTAL REPORT

RESPONSE TO SUMMARY OF SUBMISSIONS RECEIVED

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FIGURE		DRAWING NO
17	Site Selection for New Tailings Storage and Treatment Plant	2034-25

1. SITE SELECTION

1.1 General

Sites 1 to 8 listed in Table 9 of the PER were chosen as being representative of the areas within economic distance of the existing dumps which are not already committed to an exclusive present or future land use (refer Figure 17, from the PER, a copy of which is included with this document).

Sites 1 and 2 represent possible locations south of Kalgoorlie - Boulder townsite, Site 1 being west of Celebration Road and Site 2 east of Celebration Road.

Site 3 represents areas immediately to the south of the existing dumps, and Site 4, areas further south towards the shoreline of Hannan Lake.

Site 5 is representative of areas east of the dumps, between the dumps and the Trans Australia railway line. Site 6 represents areas east of the railway line.

Additional sites considered were the NKML Waste Zone (Site 7) and abandoned mine pits (Site 8).

These sites are then representative of all possible tailings disposal sites in the project vicinity, accepting that the Kalgoorlie - Boulder townsite and the active mining area along the eastern margin of the town, extending northwards from the dumps, are unavailable.

In the PER, the discussion on site selection considered firstly regional factors which led to the elimination of some sites, then dealt with more site specific factors. To clarify the site selection process applied, each site will again be discussed in turn.

1.2 Specific Comments on the Sites Considered

. Site 1 - "West of Celebration Road"

This area is classified as a parklands reserve, and is closer to Boulder than the present dumps, being less than 2 km from existing residential areas.

The area is not a current active mining area, but the presence of abandoned mine workings suggests that the area would be considered moderately to highly prospective.

Because of its distance from the existing dumps, any site west of Celebration Road would result in an additional capital and operating cost to the project of at least $2 million for slurry pipeline construction and pumping compared with the favoured site (M26/82).

Site 1 has therefore been eliminated primarily on economic grounds, although the encroachment of major mining activity to the west of Celebration Road and so close to the Boulder Townsite is also likely to be considered undesirable, as long a as suitable site exist to the east.

. Site 2 - "Cemetery Area"

Site 2, representing areas south of Boulder on the eastern side of Celebration Road, is unsuitable for siting the tailings storage, due to the insufficient area available between the assumed flood level (330m AHD) and Celebration Road to accommodate the 320 ha plant and tailings disposal site.

. Site 3 - "Common"

Areas immediately south of the existing dumps lie almost entirely within the assumed flood zone, and would be eliminated on this basis alone.

However, in addition, the site is very exposed, with no wind protection, and as such is likely to constitute a long-term potential dust hazard. Although the saline water used to process the dumps will aid in dust minimisation in the short term, the tailings storage would in time respond to wind erosion unless successful revegation is achieved. Because of the saline soils and the exposed nature of the site, revegatation would not be easy and could not be guaranteed.

Finally, the area is underlain by potentially economic mineralisation. The site coincides with the strike extension of the Golden Mile mineralized zone. Already one mine has been developed along this strike extension (Hannan South), and two further prospects adjacent to Hannan Lake are currently the subject of mine pre-feasibility studies (by Geometals NL and Ondola Investments Ltd). The likelihood of further economic mining developments within the areas typified by Site 3 must therefore be considered high.

Consequently, Site 3 is eliminated from further consideration on three grounds, viz hydrological (flood zone), aesthetic (dust and proximity to residential areas) and economic (high potential for economic mineralisation).

. **Site 4 - "Edge of Hannan Lake"**

Site 4 is located completely within the assumed flood zone, and as such is unsuitable, due to difficulties in ensuring a stable engineered tailings empoundment.

. **Site 5 - "Mining Lease M26/82"**

Site 5 is considered representative of areas between the 330m AHD flood line and the Trans Australian rail line, to the east of the present dumps. Not all of this region lies within the Lakeside Timber Reserve, however it is not possible to fit a 320 ha site between the flood zone and the railway without some encroachment onto the Lakeside Reserve.

In this respect, Site 5 which lies substantially within the Timber Reserve, but is above the flood line, is considered to be typical and representative of the region between the flood line and the railway. To avoid the Timber Reserve altogether, it would be necessary to go at least 9km to the south-east, beyond the south-eastern boundary of the Reserve. Such a distance would render the project uneconomic.

The principal objection to Site 5 (and any other sites within the region between the flood line and the railway) is that it would result in loss of part of the Timber Reserve.

Site 5 (M26/82) would involve the loss of 280ha of timber reserve (7 percent of Lakeside Reserve) which includes some areas of poorer quality, more sparsely timbered scrub near the western boundary of the Reserve. The site plans involve locating the plant, tailings storage and other facilities as close as possible to this lighter timbered zone, to minimise the impact on the better quality woodland zones.

It is anticipated that compensation will be paid by the proponent for loss of woodland within the Reserve.

Any other possible site within the area between the flood line and the railway would likewise involve loss of some part of the Timber Reserve, and would also require a compensation payment to be made.

Apart from the Timber Reserve status of the land, the area has no aspects of major objection as a tailings disposal site.

The mining lease M26/82 is preferred by the proponent above other potential sites within this zone, as it is a mining tenement held by the proponent, and is close to the present dumps. It has been subjected to condemnation drilling, which revealed no significant gold mineralisation at shallow levels.

Additionally, although the vegetation will be cleared from the plant site and tailings storage areas, the surrounding vegetation will remain. This enclosing vegetation will afford some considerable protection against wind erosion, particularly during early years when attempts are made to commence stabilisation and revegetation of the starter embankments. The trees will also provide visual screening of the operations.

. **Site 6 - "North-East of Railway"**

Site 6 shown on Figure 17 in the PER is the closest site north east of the railway. However, it is considered representative of all sites north-east of the railway.

In many respects, the region east of the railway is similar to the zone to the west, between the railway and the 330m flood line. However the land east of the railway lies outside the Timber Reserve, and is mainly pastoral lease. This represents its main advantage over Site 5, since there would be little or no clearing of timber within the Reserve.

However, there are several disadvantages attached to sites north-east of the railway. Firstly, the extra distance from the current tailings dumps and higher elevation would result in an estimated additional cost of at least $4 million in capital and operating costs for the construction of slurry pipelines and slurry pumping over the project life. Further costs would arise from access difficulties due to the need to cross the railway with slurry pipelines, water pipelines and service roads.

The land north-east of the railway is virtually all held under various mining tenements by other companies. Much of it is the subject of current active mineral exploration. Consequently a site north-east of the railway would require negotiations with other mineral tenement holders, tenement purchase and further condemnation drilling.

Finally, site drainage overall is not considered a ground for rejection of sites north-east of the railway, but more costly drainage protection works would be required compared with Site 5, being higher up the catchment where the drainage lines are better defined, steeper and more incised, with consequently higher flood streamflow velocities.

Site 6 (and sites north-east of the Trans - Australia railway in general) has been rejected by the proponent, primarily on the basis of the unacceptable additional costs for slurry pumping (at least $4 million additional cost) as well as other costs for access difficulty, drainage and mineral tenement purchase.

. **Site 7 - "NKML Waste Zone"**

NKML has advised that it is unable to accommodate the required 320 ha site within its waste zone, due to its own waste disposal requirements.

. **Site 8 - "Old Mine Pits"**

Likewise, current and future mining plans preclude the large scale use of old mine pits for disposing of tailings. Consequently, this option is not available.

1.3 Summary

The semiquantitative assessment of alternative tailings sites pointed to Sites 5 and 6 as being the only viable alternative options for the project. Sites 1, 2, 3, and 4 were eliminated because they involved very high environmental impacts ("fatal flaws"). Sites 7 and 8 were found to be unavailable.

Site 6 has been rejected in favour of Site 5, principally on economic grounds. Other factors also mitigate against Site 6, although none of these other factors alone would be sufficient to reject it from consideration. Site 6 would involve additional slurry pipeline and pumping costs of at least $4 million over the project life, as well as substantial tenement acquisition and other

costs, which would severely influence the economic viability of the project. The tailings retreatment project is marginal, and very sensitive to small increases in operating costs associated with pumping slurry over long distances.

It is noted that a typographical error in Table 12 (p. 29 of the PER) may have led to a misconception of the magnitude of additional cost involved in Site 6. The table shows relative costs of the alternative sites, using Site 5 (M26/82) as a base cost of 1.00, and not actual costs.

2. TAILINGS DISPOSAL

2.1 Four-Cell Operation

The four cell approach is not viable, as it would result in a rate of rise which is too rapid to allow adequate drainage and consolidation of the tailings. The total area of the tailings storage is the minimum necessary to permit effective drainage and consolidation of the tailings, so that subsequent raising of the embankments can be achieved using reclaimed tailings for construction material.

2.2 Floor Compaction

Site investigation work has revealed that the foundation comprises hard clayey gravels of low permeability. Consequently, compaction of the floor of tailings storage will not be necessary. The underdrainage system to be installed in order to optimise water recovery for re-use, will also reduce the hydrostatic pressures on the floor materials, to further limit the possibility for seepage losses.

2.3 Flood Diversion Works

Detailed design of the flood diversion works has been completed. The flood diversion channels are designed to pass the 1:50 year flood event, with some freeboard. Rock protection will be incorporation in the channels where necessary to control erosion.

Flood discharge ponds will be constructed at the downstream ends of the northern and eastern diversion channels to both store a portion of the discharge for use in revegetation watering on an opportunistic basis, and to enable dispersion of the overflow discharge from a broad spillway to minimise erosion down-slope.

2.4 Groundwater Monitoring

A groundwater monitoring programme will be implemented downstream from the tailings storage, as stated on p. 34 of the PER.

2.5 Fence

The entire tailings storage and plant area will be fenced.

2.6 Compensation

It is expected that compensation payments will be made for any clearing of Timber Reserve, as outlined on p. 27 of the PER.

2.7 Vegetation Clearing and Management

During the construction period, the new tailings disposal site will be cleared of vegetation. Details of the vegetation clearing operation will be submitted to CALM before commencement. Prior to bulk clearing in a chain and bulldozer operation, all salvageable sandalwood will be recovered and offered to CALM. The cleared vegetation will be windrowed or piled with a root rake blade and machine mulched. The mulch will be spread over the topsoil stock pile, providing a protective cover to wind and water erosion.

3. DUST

3.1 Dust Monitoring

Apart from the construction stage, there will be very limited potential for dust generation.

Nevertheless, dust generation will be monitored, during both the construction and operational phases. It is proposed to install dust monitoring guages, both on and off-site, and to incorporate the project's dust monitoring stations into the existing Goldfields Dust Abatement Committee dust monitoring programme.

3.2 Current Tailings Dumps

No attempt will be made to stabilise the existing dumps prior to their reclamation.

The project operations will not lead to any deterioration in dust levels from the existing dumps, and will progressively bring about an eradication of the dust problem.

4. SALINE WATER AND SLURRY PIPELINES

4.1 Pipeline Failures

The potential for breaks in the water supply pipeline has been minimised by various design aspects, including the use of non-corrosive pipe materials, burial of the line, low design operating pressures and conservative allowances for pressure surges.

In additional there will be isolation valves at regular intervals in the line to allow the broken section of line to be isolated. This will minimise the loss of saline water in the event of a break. The isolation valves can be activated rapidly once a major leak is detected.

The water supply pipeline will be inspected at least once each week for leaks. At other times, major leaks would be detected at the plant site immediately through automatic flow and pressure monitors.

The slurry pipelines will be laid above ground within a bunded channel, to contain spillage in the event of a pipeline failure. This pipeline will be checked daily for leaks, but at other times major leaks will be noted by flow and pressure monitoring at the plant.

Clearing of major tailings slurry spillages will be carried out by earthmoving equipment.

5. WATER SUPPLY

The water supply source palcochannel aquifer is located between 25 and 65m below ground level, and varies in thickness up to a maximum of around 30m. The static water levels are between 10 and 20m below ground surface.

The water supply development is predicted to cause an aquifer dewatering of between 10 and 13m. Thus groundwater levels will be around 35-45m below ground level at the completion of the project.

6. TRANSPORT

6.1 Upgrading of Roads

Anglo American Pacific Limited (AAPL) proposes to use the Mt Monger (Lakewood) Road as the access route to the Kaltails treatment plant site. As such the amount of traffic along this road will increase. The road is in poor condition in some places, notably where drainage channels transect the road adjacent to the old Lakewood townsite.

The Mt Monger Road is presently used by a number of other people. The route provides access to the pastoral lands to the East (Mt Monger and Hampton Hill stations) and also to a number of active exploration areas. The Karonie gold mine lies further to the East, and is accessed via the Mt Monger Road.

Anglo American Pacific Limited could not therefore be expected to be the sole contributor toward the upgrade of this road, given that there are so many other users. However, AAPL would be prepared to contribute a portion of the cost required to upgrade that section of the Mt Monger Road between the area of the existing tailings dumps, and the access road leading to the Kaltails treatment plant.

The nature of AAPL's contribution toward the upgrade would need to be negotiated with the Local Government authority.

6.2 Cyanide Transportation

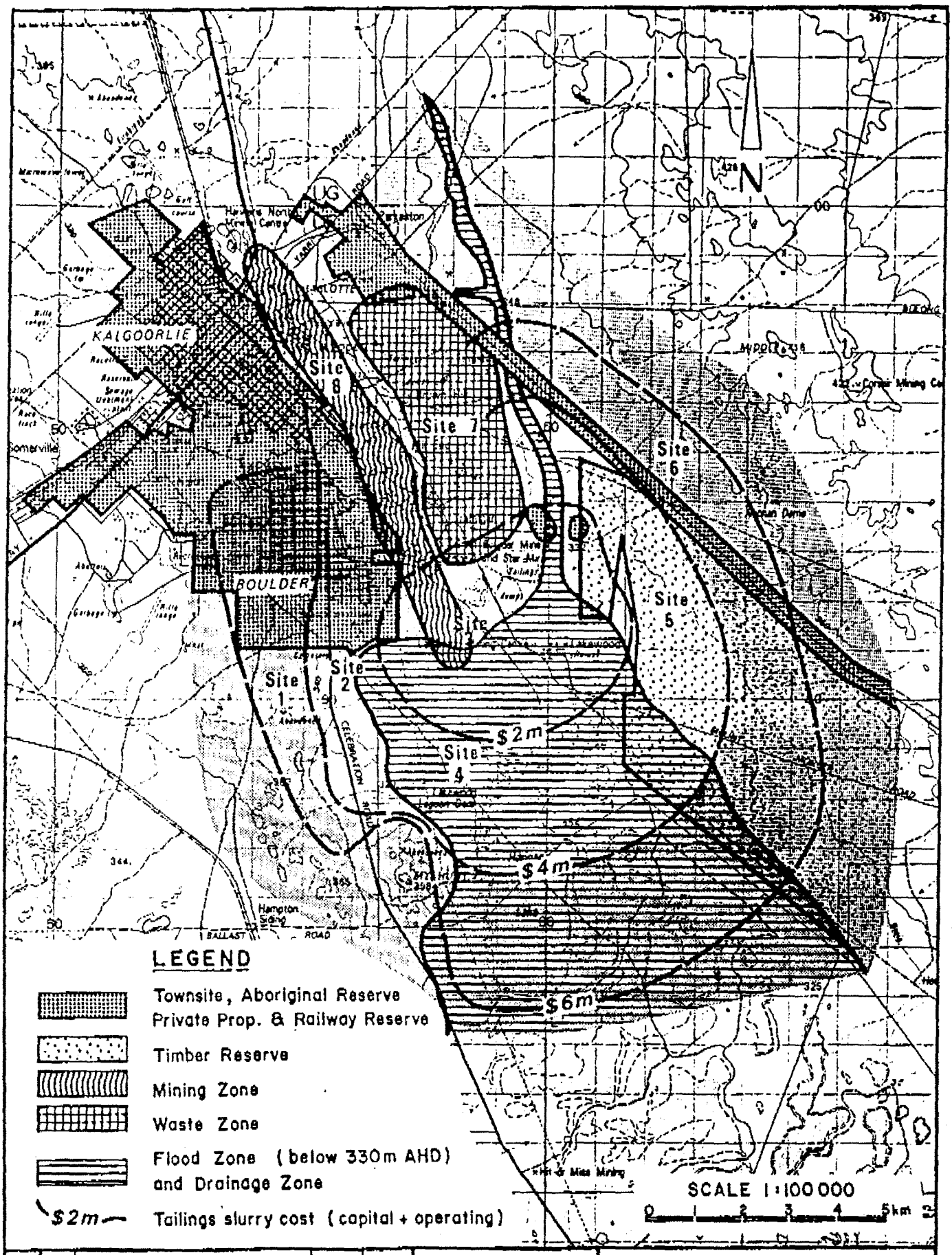
The secure transport of sodium cyanide through Kalgoorlie/Boulder to the Kaltails plant site is the sole responsibility of the sodium cyanide supplier. Only when the product has been delivered to the plant area, and correctly stored, does the sodium cyanide become the responsibility of management of the Kaltails project.

The various sodium cyanide suppliers have statutory requirements to meet in the safe transport of their product. They have developed the necessary procedures to be followed in the event of a spill. The driver of the delivery vehicle is well trained in these procedures.

By way of example, an excerpt from one supplier's sodium cyanide safety data sheet is included as Attachment A.

7. NOISE

Noise levels associated with the project are detailed on p. 50 of the PER. Noise is not expected to be a significant problem.

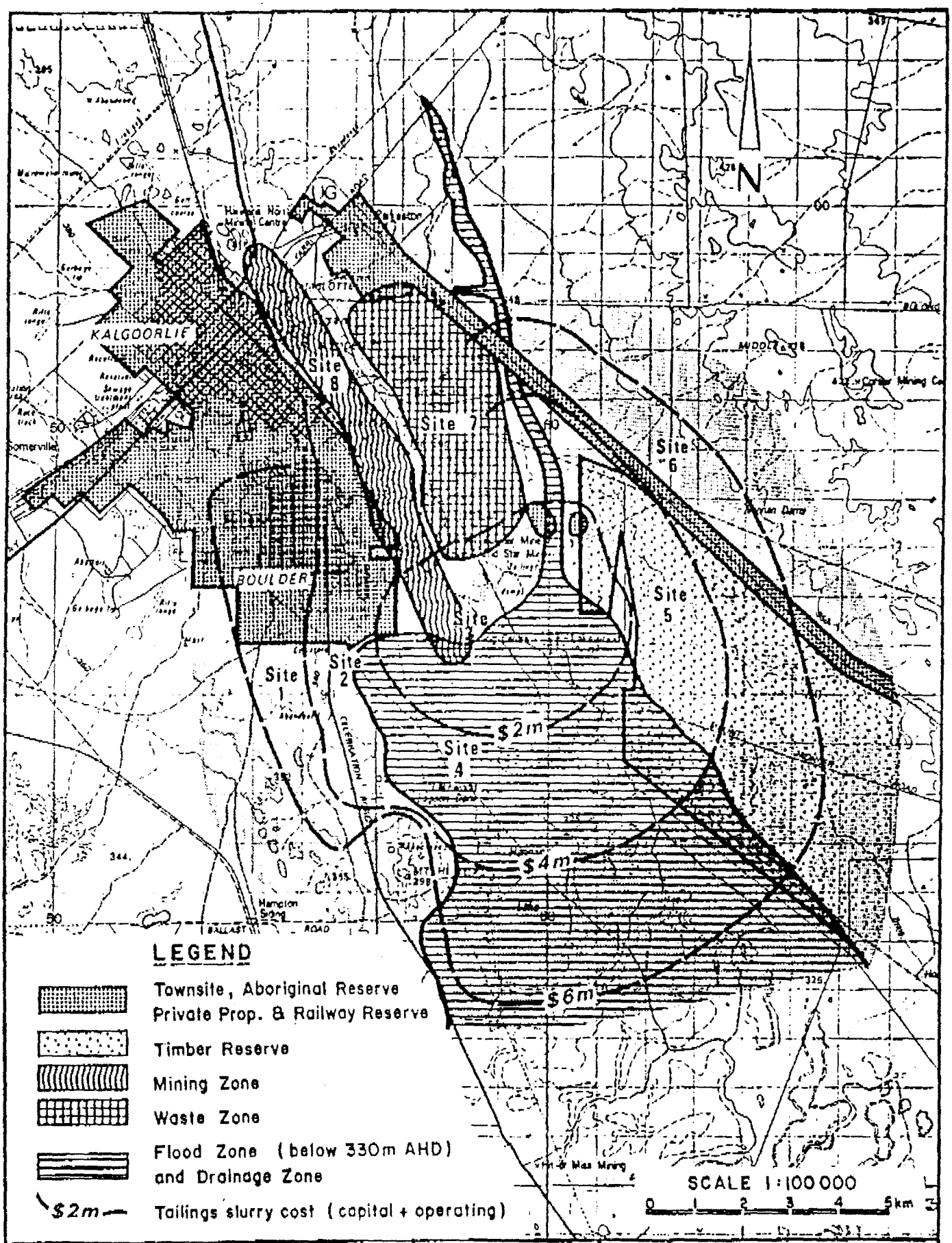


Rev	DESCRIPTION	Drawn Date	Chk'd Date

AUSTRALIAN GROUNDWATER CONSULTANTS PTY LIMITED

SITE SELECTION FOR NEW TAILINGS STORAGE AND TREATMENT PLANT

Date JAN'88 | Dwg. 2034-25 | Fig 17



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AUSTRALIAN GROUNDWATER CONSULTANTS PTY LIMITED

SITE SELECTION FOR NEW TAILINGS STORAGE AND TREATMENT PLANT

Date JAN'88 | Dwg 2034-25 | Fig 17

HANDLING:
Poisonous solid. Sealed containers may contain a build-up of highly toxic hydrogen cyanide gas - take care when opening. Avoid contact with moisture or acids to prevent formation of hydrogen cyanide. Avoid generating dust. Use good occupational work practice.

REACTION:
Contact with water (including moist air) and acids will liberate highly toxic hydrogen cyanide. Contact with oxidising agents will produce rapid reaction with significant fire risk.

STORAGE & TRANSPORT:
UN No.1689(1). Classified as a 6.1(a) (Poison) Dangerous Substance for the purposes of transport. Refer to State Regulations for storage and transport requirements. Not to be loaded with oxidising agents (class 5) corrosives (class 8) or foodstuffs. Store away from acids. Keep in a locked area. The product is a Scheduled Poison (S7) and must therefore be stored, maintained and used in accordance with the relevant State Poisons Act. Keep dry. Keep containers closed at all times. Store in well ventilated area. Check regularly for spills and leaks.

FIRE/EXPLOSION HAZARDS:
Not combustible. Decomposes on heating or on contact with moisture or acids emitting toxic fumes of hydrogen cyanide which are flammable and will therefore contribute to the fire risk. If safe to do so, remove containers from path of fire. Do not spray containers with water. Fire fighters to wear self-contained breathing apparatus.

Extinguishing media: Dry chemical powder, BCF.

SPILLS:
Clear area of all unprotected personnel. Increase ventilation. Wear full protective equipment including boots to prevent skin and eye contamination and inhalation of dust and possible vapour (hydrogen cyanide). Work up wind. Keep dry - DO NOT use water. Contain. Prevent run off into drains or waterways. If contamination of sewers or waterways has occurred advise Emergency Services immediately.

ALL VISIBLE material must be collected and sealed in drums for disposal. The spillage area should then be treated with sodium hypochlorite solution to deactivate any uncollected traces of sodium cyanide. Care needs to be taken to avoid exposure to the decontamination solution which is corrosive and may evolve chlorine gas which is toxic. Continue wearing full protective equipment to prevent skin and eye contamination and inhalation of vapours (refer to Sodium Hypochlorite Solution Safety Data Sheet if available). Inhalation of reaction products should likewise be avoided.

The spillage area should be left for approx. 1 hour if possible to allow complete reaction to occur and then the area washed down gradually with large quantities of water to ensure maximum dilution. If specialist advice is required contact ICI Australia (008-033 111-24 hr emergency number).

Note: This deactivation procedure converts the cyanide ion to the cyanate ion which on continued reaction breaks down to carbon dioxide and nitrogen.

DISPOSAL:
Refer to State Land Waste Management Authority. Empty containers MUST BE decontaminated. Waste treatment essential.

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ANGLO AMERICAN PACIFIC LTD
2034/1
APRIL 1988

KALGOORLIE TAILINGS RETREATMENT PROJECT PUBLIC ENVIRONMENTAL REPORT

RESPONSE TO SUMMARY OF SUBMISSIONS RECEIVED

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FIGURE		DRAWING NO
17	Site Selection for New Tailings Storage and Treatment Plant	2034-25

1. SITE SELECTION

1.1 General

Sites 1 to 8 listed in Table 9 of the PER were chosen as being representative of the areas within economic distance of the existing dumps which are not already committed to an exclusive present or future land use (refer Figure 17, from the PER, a copy of which is included with this document).

Sites 1 and 2 represent possible locations south of Kalgoorlie - Boulder townsite, Site 1 being west of Celebration Road and Site 2 east of Celebration Road.

Site 3 represents areas immediately to the south of the existing dumps, and Site 4, areas further south towards the shoreline of Hannan Lake.

Site 5 is representative of areas east of the dumps, between the dumps and the Trans Australia railway line. Site 6 represents areas east of the railway line.

Additional sites considered were the NKML Waste Zone (Site 7) and abandoned mine pits (Site 8).

These sites are then representative of all possible tailings disposal sites in the project vicinity, accepting that the Kalgoorlie - Boulder townsite and the active mining area along the eastern margin of the town, extending northwards from the dumps, are unavailable.

In the PER, the discussion on site selection considered firstly regional factors which led to the elimination of some sites, then dealt with more site specific factors. To clarify the site selection process applied, each site will again be discussed in turn.

1.2 Specific Comments on the Sites Considered

. Site 1 - "West of Celebration Road"

This area is classified as a parklands reserve, and is closer to Boulder than the present dumps, being less than 2 km from existing residential areas.

The area is not a current active mining area, but the presence of abandoned mine workings suggests that the area would be considered moderately to highly prospective.

Because of its distance from the existing dumps, any site west of Celebration Road would result in an additional capital and operating cost to the project of at least $2 million for slurry pipeline construction and pumping compared with the favoured site (M26/82).

Site 1 has therefore been eliminated primarily on economic grounds, although the encroachment of major mining activity to the west of Celebration Road and so close to the Boulder Townsite is also likely to be considered undesirable, as long a as suitable site exist to the east.

. Site 2 - "Cemetery Area"

Site 2, representing areas south of Boulder on the eastern side of Celebration Road, is unsuitable for siting the tailings storage, due to the insufficient area available between the assumed flood level (330m AHD) and Celebration Road to accommodate the 320 ha plant and tailings disposal site.

. Site 3 - "Common"

Areas immediately south of the existing dumps lie almost entirely within the assumed flood zone, and would be eliminated on this basis alone.

However, in addition, the site is very exposed, with no wind protection, and as such is likely to constitute a long-term potential dust hazard. Although the saline water used to process the dumps will aid in dust minimisation in the short term, the tailings storage would in time respond to wind erosion unless successful revegation is achieved. Because of the saline soils and the exposed nature of the site, revegatation would not be easy and could not be guaranteed.

Finally, the area is underlain by potentially economic mineralisation. The site coincides with the strike extension of the Golden Mile mineralized zone. Already one mine has been developed along this strike extension (Hannan South), and two further prospects adjacent to Hannan Lake are currently the subject of mine pre-feasibility studies (by Geometals NL and Ondola Investments Ltd). The likelihood of further economic mining developments within the areas typified by Site 3 must therefore be considered high.

Consequently, Site 3 is eliminated from further consideration on three grounds, viz hydrological (flood zone), aesthetic (dust and proximity to residential areas) and economic (high potential for economic mineralisation).

. **Site 4 - "Edge of Hannan Lake"**

Site 4 is located completely within the assumed flood zone, and as such is unsuitable, due to difficulties in ensuring a stable engineered tailings empoundment.

. **Site 5 - "Mining Lease M26/82"**

Site 5 is considered representative of areas between the 330m AHD flood line and the Trans Australian rail line, to the east of the present dumps. Not all of this region lies within the Lakeside Timber Reserve, however it is not possible to fit a 320 ha site between the flood zone and the railway without some encroachment onto the Lakeside Reserve.

In this respect, Site 5 which lies substantially within the Timber Reserve, but is above the flood line, is considered to be typical and representative of the region between the flood line and the railway. To avoid the Timber Reserve altogether, it would be necessary to go at least 9km to the south-east, beyond the south-eastern boundary of the Reserve. Such a distance would render the project uneconomic.

The principal objection to Site 5 (and any other sites within the region between the flood line and the railway) is that it would result in loss of part of the Timber Reserve.

Site 5 (M26/82) would involve the loss of 280ha of timber reserve (7 percent of Lakeside Reserve) which includes some areas of poorer quality, more sparsely timbered scrub near the western boundary of the Reserve. The site plans involve locating the plant, tailings storage and other facilities as close as possible to this lighter timbered zone, to minimise the impact on the better quality woodland zones.

It is anticipated that compensation will be paid by the proponent for loss of woodland within the Reserve.

Any other possible site within the area between the flood line and the railway would likewise involve loss of some part of the Timber Reserve, and would also require a compensation payment to be made.

Apart from the Timber Reserve status of the land, the area has no aspects of major objection as a tailings disposal site.

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Additionally, although the vegetation will be cleared from the plant site and tailings storage areas, the surrounding vegetation will remain. This enclosing vegetation will afford some considerable protection against wind erosion, particularly during early years when attempts are made to commence stabilisation and revegetation of the starter embankments. The trees will also provide visual screening of the operations.

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Site 6 shown on Figure 17 in the PER is the closest site north east of the railway. However, it is considered representative of all sites north-east of the railway.

In many respects, the region east of the railway is similar to the zone to the west, between the railway and the 330m flood line. However the land east of the railway lies outside the Timber Reserve, and is mainly pastoral lease. This represents its main advantage over Site 5, since there would be little or no clearing of timber within the Reserve.

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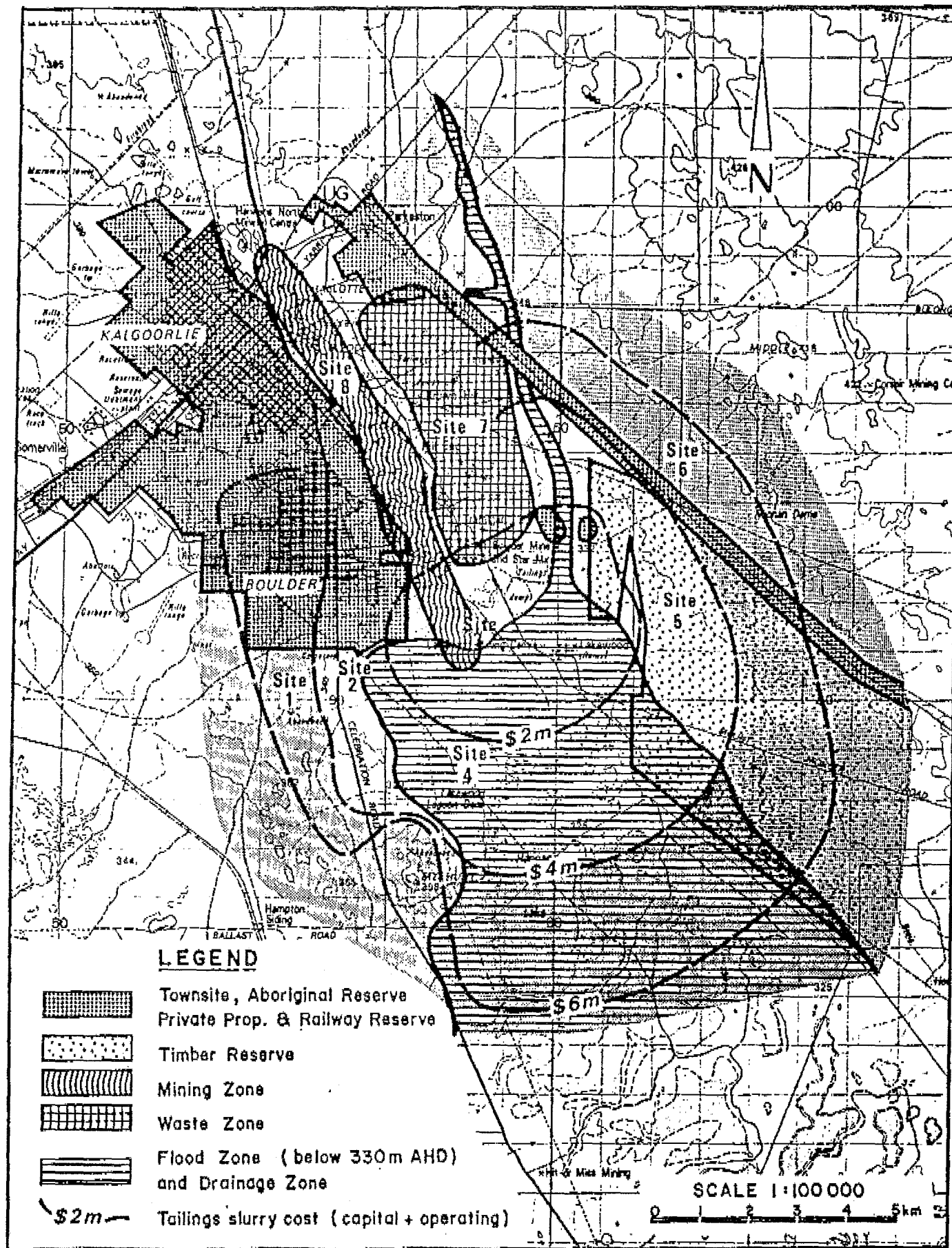
Noise levels associated with the project are detailed on p. 50 of the PER. Noise is not expected to be a significant problem.



LEGEND

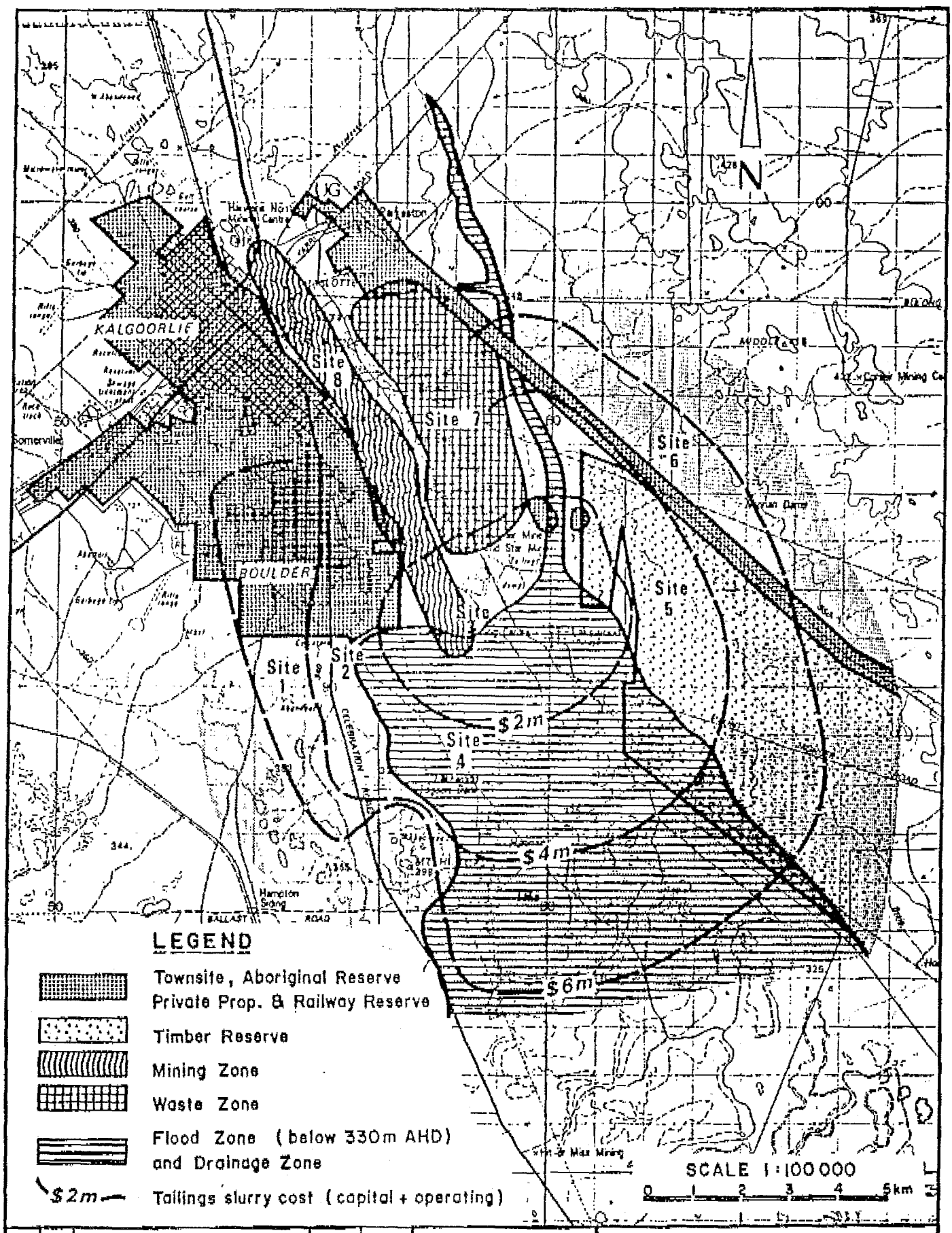
- Townsite, Aboriginal Reserve Private Prop. & Railway Reserve
- Timber Reserve
- Mining Zone
- Waste Zone
- Flood Zone (below 330m AHD) and Drainage Zone
- $2m — Tailings slurry cost (capital + operating)

Rev	DESCRIPTION	Drawn Date	Chk'd Date

AUSTRALIAN GROUNDWATER CONSULTANTS PTY LIMITED

SITE SELECTION FOR NEW TAILINGS STORAGE AND TREATMENT PLANT

Date JAN'88 | Dwg. 2034-25 | Fig. 17



Rev	DESCRIPTION	Drawn Date	Chk'd Date

AUSTRALIAN GROUNDWATER CONSULTANTS PTY LIMITED

SITE SELECTION FOR NEW TAILINGS STORAGE AND TREATMENT PLANT

Date JAN'88 | Dwg 2034-25 | Fig 17

HANDLING:
Poisonous solid. Sealed containers may contain a build-up of highly toxic hydrogen cyanide gas - take care when opening. Avoid contact with moisture or acids to prevent formation of hydrogen cyanide. Avoid generating dust. Use good occupational work practice.

REACTION:
Contact with water (including moist air) and acids will liberate highly toxic hydrogen cyanide. Contact with oxidising agents will produce rapid reaction with significant fire risk.

STORAGE & TRANSPORT:
UN No.1689(1). Classified as a 6.1(a) (Poison) Dangerous Substance for the purposes of transport. Refer to State Regulations for storage and transport requirements. Not to be loaded with oxidising agents (class 5) corrosives (class 8) or foodstuffs. Store away from acids. Keep in a locked area. The product is a Scheduled Poison (S7) and must therefore be stored, maintained and used in accordance with the relevant State Poisons Act. Keep dry. Keep containers closed at all times. Store in well ventilated area. Check regularly for spills and leaks.

FIRE/EXPLOSION HAZARDS:
Not combustible. Decomposes on heating or on contact with moisture or acids emitting toxic fumes of hydrogen cyanide which are flammable and will therefore contribute to the fire risk. If safe to do so, remove containers from path of fire. Do not spray containers with water. Fire fighters to wear self-contained breathing apparatus.

Extinguishing media: Dry chemical powder, BCF.

SPILLS:
Clear area of all unprotected personnel. Increase ventilation. Wear full protective equipment including boots to prevent skin and eye contamination and inhalation of dust and possible vapour (hydrogen cyanide). Work up wind. Keep dry - DO NOT use water. Contain. Prevent run off into drains or waterways. If contamination of sewers or waterways has occurred advise Emergency Services immediately.

ALL VISIBLE material must be collected and sealed in drums for disposal. The spillage area should then be treated with sodium hypochlorite solution to deactivate any uncollected traces of sodium cyanide. Care needs to be taken to avoid exposure to the decontamination solution which is corrosive and may evolve chlorine gas which is toxic. Continue wearing full protective equipment to prevent skin and eye contamination and inhalation of vapours (refer to Sodium Hypochlorite Solution Safety Data Sheet if available). Inhalation of reaction products should likewise be avoided.

The spillage area should be left for approx. 1 hour if possible to allow complete reaction to occur and then the area washed down gradually with large quantities of water to ensure maximum dilution. If specialist advice is required contact ICI Australia (008-033 111-24 hr emergency number).

Note: This deactivation procedure converts the cyanide ion to the cyanate ion which on continued reaction breaks down to carbon dioxide and nitrogen.

DISPOSAL:
Refer to State Land Waste Management Authority. Empty containers MUST BE decontaminated. Waste treatment essential.

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