# 3. Project Alternatives

This chapter describes various alternatives to the Project, or to components of the Project, that were considered during project planning and design. The information is primarily drawn from studies conducted by, or on behalf of, Vista Gold as part of the pre-feasibility study.

Project alternatives considered include:

- project size – grade, reserves and economics;
- mining methods;
- process selection;
- process plant location;
- re-use of existing Infrastructure;
- new infrastructure including power supply, WTP, TSFs and accommodation facilities;
- rehabilitation and closure; and
- raw material supply.

In reviewing the feasibility of alternatives, a combination of environmental, social, economic and technical elements were considered including, but not limited to:

- cultural sensitivities and impacts to sacred sites;
- logistical advantages and disadvantages;
- positive and negative impacts; and
- impacts on matters protected under relevant Commonwealth and Northern Territory legislation.

This chapter addresses section 5 of the Draft EIS Guidelines (Appendix B).

## 3.1 Not Proceeding with the Project

The implications of not proceeding with the Project include both lost opportunities and the avoidance of impacts to the environment and the community. Chapter 5 discusses project risks and opportunities.

In brief, not proceeding with the Project would result in the following:

- avoidance of environmental and heritage impacts resulting from construction and operation including:
  - disturbance to the MT26 heritage site and other potential heritage sites;
  - dust from mining activities; and
  - potential impacts on Gouldian finch habitat and the Yinberrie Hills Site of Conservation Significance.
- rehabilitation of the site would not be carried out by Vista Gold and therefore direct and indirect environmental impacts resulting from legacy site issues (e.g. AMD seepage) would continue until rehabilitation is completed by other parties;
- the Northern Territory Government would retain liability for the legacy issues surrounding rehabilitation of the mine, estimated at $150 million, and indefinite ongoing legacy issues;

- the resource base of 7.6 million ounces of gold would remain undeveloped;
- loss of economic benefit from construction of the Mt Todd Project of approximately $1.1 billion and around 450 construction jobs;
- loss of economic benefit from operation of the Project and loss of around 350 jobs that will be created by the Project;
- loss of estimated royalties over the life of the Project to the Commonwealth and Northern Territory Governments; and
- financial benefits and training opportunities for the Jawoyn people, and the wider Community would not be realised.

## 3.2 Project Size – Grade, Reserves and Economics

Vista Gold acquired the Mt Todd Gold Project in 2006 and has invested significantly in extending its resource base. Mining and processing engineering was carried out to optimise the mine production and plant throughput rates.

The current Measured and Indicated Resource is 7.6 million ounces of gold (Figure 3-1), and until May 2012, Vista Gold had been studying a 30,000 / 33,000tpd ore processing facility at Mt Todd. Since then, new information has been derived from ongoing drilling, heap leach testing and the low grade nature of the ore, and it became evident that a larger processing facility could be justified. Vista Gold has therefore revisited the scope of the Project to include a 50,000tpd ore processing facility. Table 3-1 compares the result of the engineering and optimisation of the two throughputs.

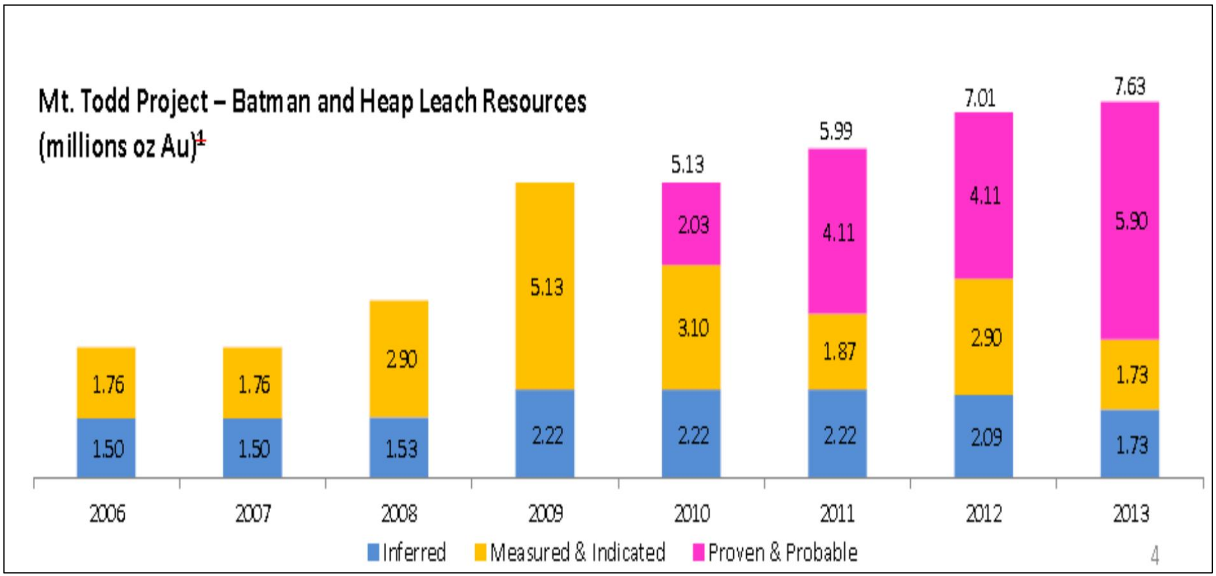


**Figure 3-1 Batman Pit and Heap Leach Measured and Indicated Resources**

**Table 3-1 Engineering and Optimisation of throughput for a 33,000tpd and 50,000tpd scenario**

| | 50,000tpd | | | | 33,000tpd | | | |
|---|---|---|---|---|---|---|---|---|
| @ $1,450/oz Au | Years 1-5 | | Life of Mine (13 years) | | Years 1-5 | | Life of Mine (13 years) | |
| | Annual Average | Total | Annual Average | Total | Annual Average | Total | Annual Average | Total |
| Average milled grade (g/t) | 1.03 | | 0.82 | | 0.95 | | 0.90 | |
| Payable gold (000 oz) | 481 | 2,407 | 370 | 4,808 | 295 | 1,473 | 263 | 2,891 |
| Gold recovery | 82.0% | | 81.5% | | 82.0% | | 81.5% | |
| Cash costs ($/oz) | $662 | | $773 | | $676 | | $684 | |
| Strip ratio (W:O) | 2.5 | | 2.7 | | 2.1 | | 2.2 | |
| Initial capital ($M) | | | $1,046 | | | | $761 | |
| Pre-tax Net Present Value $(NPV)_{5\%}$ ($M) | | | $1,094 | | | | $770 | |
| After-tax $NPV_{5\%}$ ($M) | | | $591 | | | | $440 | |
| Internal Rate of Return (Pre-tax / After-tax) | | | 21.8% / 15.9% | | | | 22.1% / 16.9% | |
| After-tax payback (production years) | | | 3.5 | | | | 3.2 | |

The 50,000tpd scenario generates a larger Net Present Value. The 33,000tpd development will provide maximised returns and operating margins. The difference in total disturbance area between these two options is approximately 5% primarily due to larger pit and a larger waste rock dump.

For the purpose of the Draft EIS, Vista Gold is seeking approval for the 50,000tpd Project.

## 3.3 Mining Method Selection

The two alternative methods of mining that were considered were underground and open cut.

Underground mining is not economically feasible because average gold grades are too low to support the higher costs ($/t) associated with underground mining. Further, underground mining would not support the production rate required to make the Project feasible.

Open cut mining has been chosen as the mining method based on better economics and recovery of the mineralised resource, and known common practice in the mining industry.

The Pit will be mined using an open cut mining method. This will involve an expansion of the current open cut pit in all directions. The method requires use of drilling and blasting for initial fragmentation of material so that it can be excavated via shovels and trucks. This method of mining is proven and is in current use throughout the world. The method provides safe and efficient access to ore and waste, without excessive dilution of ore.

The proposed pit expansion will encroach into the Yinberrie Hills Site of Conservation Significance (SOCS) including breeding and foraging habitat for the Gouldian finch. The direct impact to the breeding habitat is unavoidable if the resource is to be realised.

## 3.4 Process Selection

Two ore processing methodologies were considered, floatation and CIL.

In 2006, flotation test work was completed. The rougher flotation tests resulted in 80% gold recovery to concentrate at a grind size of 75 micrograms (μm). Desliming and regrinding of rougher tailings followed by a scavenger flotation stage improved overall gold recovery in concentrate to approximately 85%.

Analysis of copper concentrate test work indicated that the dominant sulfide minerals in the resource consisted of pyrrhotite and chalcopyrite (a primary copper mineral). It was concluded that the production of a "saleable" copper concentrate was not as viable as previous test work had indicated, and that the processing challenges associated with cyanide soluble copper encountered in previous operations at Mt Todd would be less of a problem when treating the deeper primary ore.

Further, the preliminary rougher flotation tests achieved poor copper recoveries of only 40% to 45%, which was not deemed sufficient to justify the inclusion of a flotation circuit in the flow sheet, and flotation was not pursued further as a potential processing path for the Batman ores. Therefore the flotation of copper was deemed unnecessary and a whole ore leach process flow sheet was pursued instead, focusing on gold recovery.

The detailed metallurgical test work program included the determination of comminution characteristics and optimum grind size for the ore, development of cyanidation and leach conditions and determination of reagent consumption requirements.

Key conclusions drawn from the test work programs on the ore samples from the Batman deposit are summarised as follows:

- Batman ore is considered to be free-milling and non "preg-robbing" and is amenable to gold extraction by conventional cyanidation processes;
- Batman ore is competent to very competent with above average hardness, and processing of these ores is best suited to high pressure grinding and ball milling;
- the two main ore types in the Batman deposit are oxide ore and sulfide ore classified by their different leach performance and reagent consumption rates, and categorised by depth. The oxide ore is defined as material above the base of oxidation while the sulfide ore is below the base of oxidation);
- pre-conditioning test work showed no benefit for either gold recovery or sodium cyanide (NaCN) consumption;
- oxygen addition displayed no benefit to leach kinetics over air addition; and
- the HPGR test work confirmed that a high circulating load and high unit specific energy (4.1kWh/t) were necessary for the Mt Todd ores.

The design of the processing plant was based on these test work findings i.e. to treat free milling ore using conventional technology, to recover cyanide leachable gold using a CIL process and a plan that will consist of a gyrator crusher, secondary crushers, coarse screening, coarse ore stockpile, HPGR, fine screening, classification, ball mills, pre-leach thickener, CIL circuit, elution circuit, gold room, cyanide detoxification and tailings discharge.

## 3.5 Process Plant Location

The proposed process plant and operations area will accommodate administration and plant site buildings, the ore processing plant, power station and WTP. Options for the location of this infrastructure included consideration of the following:

- use of the previous process plant and administration area for construction of new infrastructure; and
- rehabilitation of the previous process plant and administration area, and construction of this infrastructure at an alternative location.

It is proposed to build the new plant in approximately same location as the previous plant due to the following considerations:

- capital savings in the earth works costs (engineered fill material on existing site);
- close proximity to existing roads;
- close proximity to the gas pipe line;
- close proximity to existing power grid;
- availability of existing drainage, water and other services for construction of temporary facilities;
- the area is central to key elements of mine operations including the pit which reduces ore haul distances and the length of power and water supply services; and
- there is no alternative area which could be developed that is centrally located, without the need for significant earthworks and additional infrastructure development.

## 3.6 Reuse of Existing Project Components

As part of mine planning conducted by previous proponents, the importance of the Yinberrie Hills for Gouldian finch habitat was apparent, and the then proposed (now existing) WRD, processing plant and TSF were relocated outside the breeding habitat.

The rationale for retention of existing components in the proposed operation centres is based on one or more of the following:

- there is capacity available that can be used, which either removes the need for additional disturbance or reduces the area of future disturbance once existing capacity is exhausted; and
- project components are located close to operations which reduces haul distances and materials handling infrastructure (conveyors, transfer points etc.).

### 3.6.1 Waste Rock Dump

Mining will result in the generation of approximately 560Mt of waste rock over the life of the Project. Some of this material (68Mt) will be used in construction of additional capacity in TSF1 and for the new TSF2 and for rehabilitation activities such as cover for the TSFs and the HLP. The balance of the waste will be disposed in the WRD.

Options considered for the WRD included:

- expansion of the WRD from its current area of 70ha to around 217ha and height of 24m to approximately 350m above ground level; and
- rehabilitation of the existing WRD and construction of a new WRD.

The preferred option is to expand the existing WRD. This was based on the following considerations:

- the existing WRD is already a disturbed area and its expansion therefore minimises potential new disturbance;
- the existing WRD is located as close as practicable to the pit and provides the best option from a materials handling and economic perspective;
- the proposed progressive rehabilitation / capping of the expanded WRD will allow for successful rehabilitation of the legacy associated with an existing un-rehabilitated WRD; and
- a single WRD has a smaller surface area to volume ratio than several smaller WRDs, resulting in lower rehabilitation costs.

The direction of expansion of the proposed WRD was selected to avoid impacting West Creek and the water catchment to the southwest, thus minimising potential environmental impacts and to maintain the safety impact zone to the north.

The ultimate height of the WRD (350m above ground level) was selected in order to:

- provide a design to accommodate the volume of waste rock required;
- avoid creation of a second WRD;
- provide an economically feasible WRD design;
- minimise haulage costs and therefore fuel consumption costs associated with the WRD; and
- maximise the effectiveness of the cover.

### 3.6.2 Tailings Storage Facility 1

The existing TSF1 was designed for a maximum tailings storage capacity of 70Mt (Knight Pièsold 1996). Only 9Mt of ore was processed during the period between 1996 and 2000 when the mine was in operation (MWH 2006), and an additional 60Mt of tailings can therefore be stored in the existing TSF1 through staged vertical expansions of the facility.

The original design of TSF1 consisted of an initial waste rock embankment with a crest elevation of 141.0m. The proposed construction plan included subsequent raises constructed annually using a combination of modified centreline and upstream techniques. The current plans for TSF 1 include sequential raising of the existing TSF1 to a maximum ultimate crest elevation of 158.0m to store approximately 60Mt of additional tailings.

The alternative to re-commissioning TSF1 for tailings storage is to construct a larger TSF2 to store an additional 60Mt of tailings. A larger TSF2 footprint would result in significantly higher initial capital costs associated with foundation preparation, embankment construction, liner and overdrain installation. A larger TSF2 footprint would also result in increased disturbance to Horseshoe and Stow creeks, requiring larger diversion channels.

The re-commissioning of the existing TSF1 to store tailings during initial production results in significant savings in initial capital costs associated with foundation preparation and starter embankment construction. As such, the proposed option is to increase capacity in TSF1 (by raising the embankment), thicken the tailings to achieve higher tailings densities, and construct TSF2 to commence accepting tailings from mining year 4. The capacity in TSF1 will be increased with no significant increase to the existing disturbance footprint and the interim use of TSF1 results in TSF2 having a smaller footprint.

### 3.6.3 Raw Water Dam

Processing facilities will require approximately 1,500m$^3$ of water per hour with additional water required around the site for environmental controls. Surface water supply from existing water courses and groundwater supply would not provide the necessary volume and / or reliability.

The viable supply option for this volume of water is a combination of recycling (and treatment) of process water from the TSFs, and water drawn from the existing Raw Water Dam.

## 3.7 New Infrastructure and Facilities

Re-establishment of operations at Mt Todd will require the construction of new infrastructure and facilities. Key infrastructure includes a power station, Ore Processing Plant, WTP and a second TSF.

### 3.7.1 Power Supply

Three options were considered for power supply (Power Engineers 2013 cited in Tetra Tech 2013):

#### Option 1: Connect to the existing utility grid

The mine site has a connection to the local utility grid via two existing 22kV transmission lines. Discussions between Vista Gold and Power and Water Corporation (PWC) indicate that approximately 20MW of power from the existing PWC grid could be available for purchase by the Project. The available 20MW from the utility grid is insufficient to meet estimated operational power requirements of the Project.

Option 1 is proposed for the construction phase prior to establishment of an onsite power station, and during maintenance periods if power shortfall occurs.

#### Option 2: On-site power station, gas turbine driven generator sets, no spare sets

Gas turbines use slightly more fuel than reciprocating engines but are more reliable, require significantly fewer planned outages and have lower maintenance costs.

Fuel for the power station would be provided via an existing high-pressure gas spur line which tees off from the main Alice Springs to Darwin gas pipeline.

The manufacturers and generator set types considered were:

- Rolls Royce: 1 x Trent 60 WLE
- General Electric: 2 x LM2500+

Each generator set was analysed for its suitability to the Project based on performance, feasibility to produce on-site electrical power, capacity and consideration for the export of excess power to the local utility grid. Based on these criteria and assumptions at the time (56MW demand for normal operations), the following conclusions were made:

- the Rolls Royce Trent 60 was the only single aero-derivative gas turbine that could meet the entire site load, with reserve capacity to support a future expansion or for export to the utility grid; and
- the two General Electric LM2500+ sets have the lowest initial cost, but are less efficient, resulting in a higher fuel cost than the Rolls Royce Trent 60.

The pre-feasibility study also considered the option of installing a Rolls Royce Trent 60 WLE Combustion Turbine and 2 x MAN 20V35/44SG Reciprocating Engines to support the 50,000tpd operation. Total power generation capacity (installed) will be approximately 76MW. Normal site electrical demand is 86MW and peak demand is approximately 95MW. The shortfall in power will be obtained from the grid.

This option was selected as the preferred power supply for the Project.

#### Option 3: On site power station: Reciprocating gas engine driven generator sets, one spare set

Fuel for the power station would be provided via an existing high-pressure gas spur line which tees off from the main Alice Springs to Darwin gas pipeline.

The manufacturers and generator set types considered (Power Engineers 2010 cited in Tetra Tech 2011) were:

- MAN: 6 x 18V51/60G
- MAN: 8 x 14V51/60G
- Wartsila: 9 x 20V34SG

The MAN engines require diesel “pilot injection” (about 1% of the total fuel draw) to ignite the main gas charge. This in turn requires diesel storage infrastructure installation and maintenance.

The Wartsila reciprocating engines run on 100% gas fuel, and this option was estimated to provide the lowest overall cost for the project duration (Tetra Tech 2013).

In addition to their increased fuel efficiency, reciprocating gas engines have an advantage at sites such as Mt Todd because the electrical output and thermal efficiency remains constant over a large range of ambient conditions. This is especially pronounced at high temperatures when air density is less than ideal for gas turbines (Power Engineers 2012).

A major disadvantage with a reciprocating engine power plant is the need to install a spare engine (included in the numbers stated above) to cover genset downtime due to a higher frequency of unplanned shutdowns and planned shutdowns for maintenance (approximately 800 hours per year).

In addition to offline maintenance, reciprocating engine power stations require at least one full time operator to ensure proper operation and to address minor ongoing maintenance functions.

Option 3 is not proposed.

### 3.7.2 Power Station Location

Three locations for the power station were considered. The first location was on the footprint of the previous power station, immediately adjacent to the north side of the mine site access road. The second location was immediately adjacent to the south side of the mine site access road, opposite the proposed process plant area. The third location was near West Creek adjacent to the WRD, approximately 1km south of the HLP.

Initially, the preferred location for the power station was the original power station footprint, with the option to install up to 2 x MAN 20V35/44SG reciprocating gas engines on a secondary site. This option would allow connection to existing utilities such as water and gas supply, wastewater treatment and the firewater loop.

During refinement of the site layout, it became apparent that this location was not suitable because the power station would fall under a proposed conveyor. As a result, the second option was selected and, although outside the immediate process plant area, it was still close to the gas supply.

Further refinement of the mine footprint resulted in consideration of a third option which is the proposed option. The proposed location provides for emergency access, maintenance access and requires minimal gas piping works. The new location of the power station outside of the gate house will:

- minimise the potential impact to the power station of dust from the process plant area, and thus minimise maintenance requirements of the inlet filters and risk of compressor fouling by dust; and
- provide flexible access (outside mining area) if Vista Gold decides to sub-contract the power station operation.

### 3.7.3 Water Treatment

The Batman Pit (RP3) currently holds approximately 10 gigalitres of water that needs to be disposed of off-site during the pre-production phase in order to allow mining to recommence. The primary focus to date has been the identification of options to treat this water to a level that allows discharged water to meet off-site effluent discharge quality criteria (monitoring values) in accordance with the WDL.

Three scenarios were considered in order to treat and discharge the water in RP3 during the pre-production phase:

- full treatment ex-situ in a pre-production WTP;
- in situ treatment; and
- in situ treatment in a life of mine WTP.

#### Ex-situ Treatment in a Pre-production WTP

This method would employ a two stage lime precipitation process followed by a membrane filtration system, and sized to treat 1,600$m^3$/h. A schematic of this process is shown in Figure 3-2.

#### In-situ Treatment

Vista Gold developed a treatment process for RP3 that involved treating the entire pit at once with finely ground limestone ($CaCO_3$) and quicklime (CaO). Ten thousand tons of calcium carbonate and two thousand tons of quicklime were added to the pit water in order to bring the pit to a pH of approximately 7.4. Most of the metals precipitated out.

#### In-situ Treatment in a Life-of-Mine WTP

The third scenario was to build a life of mine WTP in combination with the in-situ treatment process described above. The life of mine WTP would be designed to meet interim site specific trigger values during the Wet Season at a capacity of 500$m^3$/h (Tetra Tech 2012).

#### Conclusion

A three stage approach has been adopted to handle the water currently on the Mt Todd site, and for excess water that accumulates on the site over the life of the mine. The three stages included:

- treatment of pit water in-situ with micronised lime during the 2012 / 2013 Wet Season;
- discharge of the treated water from the pit in the 2013-2014 Wet Season, concluding prior to the 2014 Dry Season; and then

- following a decision to move ahead with the Project, design, procure and construct a WTP for use throughout the operational life of the mine and the anticipated four year reclamation and closure period.

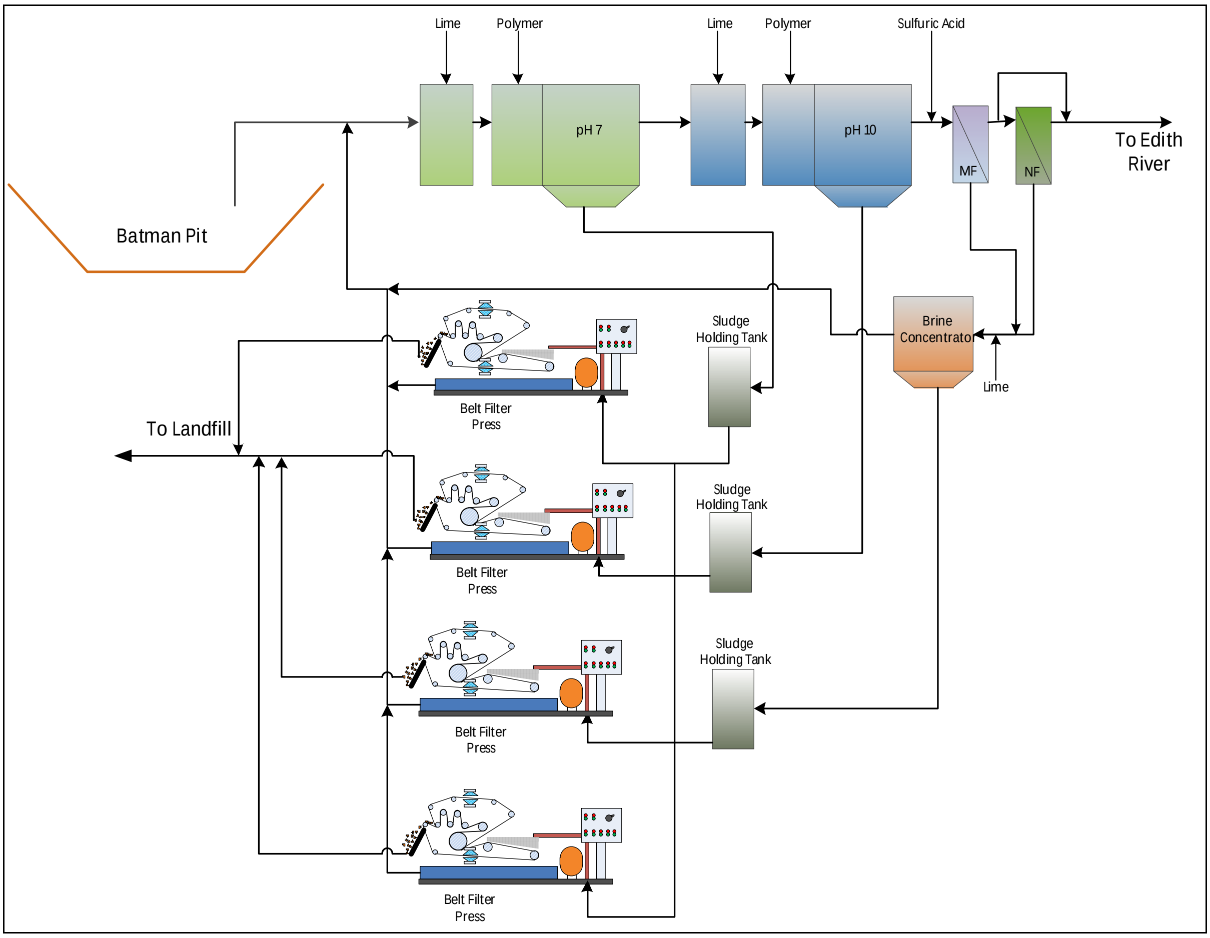


**Figure 3-2 Pre-production Water Treatment Plant**

Source: Tetra Tech (2012)

### 3.7.4 Tailings Storage Facility 2

#### Location

Site selection for the location of TSF2 took into account the following criteria:

- avoid impact on sites of conservation, historical or heritage value (in particular the initial TSF2 location was moved to avoid Mt Todd (a sacred site);
- maximise existing topography / minimise earthworks; and
- locate as close as practicable to operations to minimise the cost of materials transport / transfer.

The proposed location of TSF2 focuses development to the east of Batman Pit, avoiding impact on the Yinberrie Hills and West Creek.

The area south of the HLP was initially considered however it is a drainage area for Horseshoe Creek and Stow Creek, it is waterlogged in the Wet Season, and is not large enough for TSF2.

The proposed location of TSF2 was chosen because it is one of the flattest locations on the site. It minimises the need for cut and fill and utilises the natural topography of the hills on the eastern edge to further minimise earthworks.

The current TSF2 configuration is designed to avoid disturbance within a Restricted Work Area (RWA3) which encompasses Mt Todd. To avoid construction works within RWA3, TSF2 needs to be located south of Mt Todd, and therefore it is necessary to undertake limited construction within Horseshoe and Stow creeks. Diversion channels will be constructed around TSF2 to divert flows within these creeks. Complete avoidance of disturbance to Horseshoe and Stow creeks would require a significant reduction in the TSF2 footprint with a concomitant increase in the ultimate height and rate of filling, both of which would affect the structural stability of the facility.

### Construction Techniques

The following six options were evaluated for tailings disposal within TSF2 (Tetra Tech 2013):

- Option 1 - conventional TSF with downstream raise construction;
- Option 2 - thickened TSF with downstream raise construction;
- Option 3 - dry stack TSF;
- Option 4 - conventional TSF with upstream raise construction;
- Option 5 - thickened TSF with upstream raise construction; and
- Option 6 - cycloned TSF.

The study showed that due to the relatively flat topography, a conventional, slurried tailings impoundment with the capacity to contain the target amount of tailings would be very large. The size of the impoundment could be reduced by thickening the tailings to achieve a higher in-place density and construction costs could be minimised by using upstream construction methods for embankment raises.

The most inexpensive tailings storage option is Option 3, the dry stack TSF which involves dewatering the tailings prior to deposition in the TSF. Although construction costs associated with dry stacking are lower than the other options, the cost of the conveyors and dewatering system make this alternative cost-prohibitive. Additionally, dry stack tailings management is less effective in areas that receive significant rainfall due to difficult material handling and trafficability conditions associated with wet tailings.

The most expensive design is Option 1, the conventional TSF with downstream raise construction methods. Additionally, downstream construction results in a larger TSF footprint compared to upstream construction. The heritage survey (Appendix Q) identified several historical and Aboriginal heritage sites within the larger footprint of the proposed TSF2. The smaller TSF2 footprint associated with the upstream construction minimises impacts to heritage sites in this area (Tetra Tech 2012d).

Option 6, the cycloned TSF, has fairly low construction costs, but the design is less stable than traditional construction techniques and may result in much higher environmental risk given the intense rainfall experienced in the region each Wet Season.

Based on economic and environmental considerations, a design with upstream construction methods and thickened tailings deposition has been adopted for TSF2 (Option 5). The TSF will be lined with a LLDPE liner underlain by a GCL as bedding material. The costs associated with a GCL bedding layer were lower than a compacted natural subgrade due to the gravelly surficial soils at the site (Tetra Tech 2012c).

### 3.7.5 Accommodation Facility

At the onset of the Project, the Proponent indicated a preference to assist in local development and to discourage or minimise the need for the fly-in fly-out / drive-in drive-out (FIFO / DIDO) model. Numerous alternatives were evaluated for the housing of construction and operations personnel including:

- a purpose built construction camp;
- an accommodation camp on-site;
- establishment of a new suburb in Katherine with real estate investors constructing housing as part of a head lease arrangement for operations personnel;
- a combination of integrated housing utilising existing land availability and constructing new houses;
- purchasing existing houses and renovating if required; and
- a potential smaller sub-development, coupled with both a single person accommodation camp in proximity to Mt Todd and a single person facility in the Katherine area.

Factors considered included:

- availability of existing property for rent and purchase;
- expectations of the workforce;
- preferences for lifestyle choice such as choosing to live in Darwin, Pine Creek or Katherine;
- financial considerations; and
- access to the mine site in the event of Katherine River flooding.

Current data indicates that housing rental and purchase options are:

- limited within the Katherine region;
- subject to potential increases beyond existing values; and
- weekly rental costs and capital value are largely determined by social and environmental impacts in the region.

Potential financial investors may be interested in participating in the housing solution for Vista Gold workers in Katherine. Findings of initial stakeholder and community consultation indicated the preferred location for a construction camp outside of the Katherine township. As the Project progressed, options were refined and three locations for siting of a construction camp were identified within 25km of the mine site. Aspects considered in site selection included:

- distance to site;
- area available for development;
- susceptibility to flooding;
- access road requirements;
- health and safety requirements;
- need for a development application; and
- location in proximity to utilities, services and neighbouring properties.

The location of the camp is still to be determined.

Accommodation options for the operations workforce of 350 were refined for assessment in the Draft EIS. With an assumption that 60 workers currently reside in the region, the proposed option is a combination of a camp and use of existing accommodation as follows:

- 70 workers at the construction camp. This would accommodate mainly FIFO / DIDO personnel and provide an ability to quickly increase capacity to house overflow peak period personnel to meet mining needs or maintenance shut downs;
- 120 workers (family households with or without children) in a mixture of:
  - new three and four bedroom houses located on existing vacant Katherine and regional land;
  - existing (renovated if required) houses located in Katherine and regionally; and
  - subject to real estate availability at the time of the arrangement, a small contained development on Katherine land.
- 100 workers located in a Katherine based single person accommodation facility.

The ultimate accommodation strategy adopted will be developed following further discussions with local and Northern Territory Government agencies. The accommodation arrangements will be subject to a separate approval process.

Vista Gold will refine and confirm the employee accommodation requirements post determination of the environmental assessment.

## 3.8 Rehabilitation and Closure

### 3.8.1 Heap Leach Pad

The HLP will be reprocessed after the last ore is removed from the Batman pit. The rationale for this is that:

- rehabilitation provides no economic benefit;
- reprocessing adds economic benefit to the end of the mine life; and
- reprocessing the heap leach reduces future environmental liabilities.

### 3.8.2 Waste Rock Dump

Options considered for the WRD cover include a GCL and store and release cover. The proposed GCL cover design, in addition to placement of NAF waste rock around the perimeter of each bench, was selected to minimise the potential for AMD seepage and mine waste exposure due to erosion. Material for the store and release cap would likely be available within 20km of the process plant area.

Cover system options will be refined during the detailed design phase of the Project and throughout the life of the Project. The Draft Reclamation Plan (Appendix Y) recommends specific closure investigations necessary to address information gaps including the following in relation to the WRD:

- an analysis of waste and cover material hydraulic properties;
- a site-wide soils, closure cover and reclamation material inventory and characterisation study; and
- a waste and closure cover erosion and sediment control study.

### 3.8.3 Tailings Storage Facilities

A preliminary evaluation of the hydrologic performance of potential closure covers was undertaken to determine if a "store and release" cover could be constructed for TSF1 and TSF2 using locally available soils (Tetra Tech 2013). The evaluation of closure cover performance was carried out using the variably-saturated flow model, VADOSE/W, in a one-dimensional mode under average climatic conditions at the site. One lithologic unit that will be excavated during renewed mining, a greywacke, was identified at Mt Todd that may be a good candidate for closure cover material. Based on the preliminary results of this analysis, it appears that constructing a "net zero flux" cover at Mt Todd is feasible by constructing a 1m cover composed of greywacke waste rock. To allow equipment access for the installation of the store and release cover on the TSFs, a 1m cover of NAF waste rock was assumed to be necessary to bridge the thixotropic tailings located on the impounded surface. The net flux of annual precipitation through the 2m thick cover was estimated to be zero. These estimates are based on assumed properties (e.g. incident precipitation, foot print area, catchment area runoff, total and drainable porosity, saturated volume, runoff rate, evaporation rate) of the greywacke, non PAF waste rock and TSF over the mine-life.

## 3.9 Raw Materials

### 3.9.1 Lime

The Project will require up to 17,100t of quicklime per year for processing and water treatment. Two options were considered for the supply of lime to the Project:

- establishment of a limestone quarry approximately 20km west of the mine for the supply of around 102,000tpa of limestone that would be trucked to the mine site and fed into a vertical lime kiln; and
- purchase of lime from an existing source.

An economic trade-off study to operate a limestone quarry versus direct purchase was performed. The establishment of a quarry, trucking of limestone and operation of a lime kiln was not cost effective compared to delivery of lime direct to the mine. Lime will therefore be purchased on the open market and delivered to Mt Todd by the provider. Long term, a lime plant is proposed for the Mataranka area by other proponents and could be a source in the future.

### 3.9.2 Low Permeability Material and Plant Growth Medium

Clay, particle size bedding and fines will be required for cover material to effectively close the WRD and act as a protective layer over the GCL. Low permeability material, NAF waste rock and PGM will be required for cover for rehabilitation of the HLP site, TSF1, TSF2, LGO2 and the process plant area.

Where available, low permeability material will be sourced on-site. Where there is a lack of such material at site, low permeability material (such as a Kaolinite and Montmorillonite clay blend) will be imported (Vista Gold *pers. comm.*).

PGM will be available on-site in existing stockpiles and from salvage below disturbance areas (e.g. TSF2 and the expanded WRD). Material salvaged from construction and expansion of facilities will yield an average of 0.2m depth of PGM (Tetra Tech 2012b).