GHD CLIENTS | PEOPLE | PERFORMANCE

MEMORANDUM

08 April 2010

To	Colleen Murphy (Shire of Serpentine Jarrahdale)		
Copy to			
From	Bradley van Blomestein	Tel	6222 8586
Subject	Hydrogeological Assessment of Application: Proposed Mineral Sands Mine	Job no.	61/25341

As requested please find an analysis of the documentation presented to the Serpentine - Jarradale Shire and the Shire of Murray in support of extractive industries licenses. The assessment has been carried out with regard to the hydrogeological aspects of the application.

Five documents have been presented for the evaluation. These are;

Keysbrook Mineral sand Project – Water Management Plan

Keysbrook Mineral Sand Project - Acid Sulfate Soils Management plan

Keysbrook Mineral Sand Project - Public Environmental Review Response to Submissions

Keysbrook Mineral Sand Project - Public Environmental Review

Application for Approval to Commence Development -Proposed Industry Extractive - Various Lots Keysbrook.

1 Relevant Legislative Requirements and standards regarding hydrogeological impacts as relevant to a mineral sands extractive industry

The following guidelines have relevance as regards the requirements and standards regarding hydrogeological impacts as relevant to a mineral sands extractive industry

GHD GHD House 239 Adelaide Terrace Perth WA 6004 PO Box 3106 Perth Adelaide TCE WA 6832 Australia
T 61 8 6222 8222 **F** 61 8 6222 8555 **E** permail@ghd.com.au **W** www.ghd.com.au

Policies, legislation and guidelines as applicable to the proposal

Table 1 State and Commonwealth legislation that may be applicable to the project

Legislation	Responsible Government Agency	Aspect
Commonwealth Legislation		
National Water Quality Management Strategy (1994)		The Strategy was introduced to provide a process to manage the nation's water bodies in an environmentally sustainable way. The main policy objective of the NWQMS is, "to achieve sustainable use of the nation's water resources by protecting and enhancing their quality while maintaining economic and social development."
State Government Legislation		
Environmental Protection Act 1986 (Part IV)	Environmental Protection Authority, Department of Environment and Conservation	Environmental Impact Assessment and management
Environmental Protection Act 1986 (Part V)	Department of Environment and Conservation	Licensing, Prescribed Premises
Fire and Emergency Services Authority of Western Australia Act 1998	Fire and Emergency Services Authority	Emergency services; spillage (in transit or on-site chemicals), industrial fire,
Mining Act 1978	Department of Industry and Resources	Land access and management, mining proposals

GHD GHD House 239 Adelaide Terrace Perth WA 6004 PO Box 3106 Perth Adelaide TCE WA 6832 Australia
T 61 8 6222 8222 **F** 61 8 6222 8555 **E** permail@ghd.com.au **W** www.ghd.com.au

Legislation	Responsible Government Agency	Aspect
Rights in Water and Irrigation Act 1914	Department of Water	Access to and use of water resources
Revised Draft Environmental Protection (Swan Coastal Plain Wetlands) Policy and Regulations 2004.	Department of Environment and Conservation	Identifies conservation category wetlands on the Swan Coastal Plain.
Waterways Conservation Act, 1976	Department of Water	Protection of surface and groundwater
Contaminated Sites Act 2003	Department of Environment and Conservation	Management of pollution
Country Areas Water Supply Act 1947. Metropolitan Water Supply, Sewerage and Drainage Act 1909	Department of Water	Establishes an area as a Public Drinking Water Source Area (PDWSA) to ensure long-term protection • Provides the power to manage development, operations and activities in PDWSAs to protect water quality
Fire and Emergency Services Authority of Western Australia Act 1998	Fire and Emergency Services Authority	Emergency services; spillage (in transit or on-site chemicals), industrial fire,
Land Drainage Act 1925		
Land Administration Act 1997		
Local Government Act 1995	Shire of Serpentine Jarrahdale/ Shire of Murray	Development approvals and management
Local Government (Miscellaneous Provisions) Act 1960	Shire of Serpentine Jarrahdale/ Shire of Murray	Community issues / resources / facilities

Legislation	Responsible Government Agency	Aspect
Health Act 1911 • Safety of community water supplies	Department of Health (Environmental Health) and Local Government Authorities	Ensures quality of water meets health guidelines of the Australian Drinking Water Guidelines
Mining Act 1978	Department of Industry and Resources	Land access and management
Water Agencies (Powers) Act 1984	Department of Water	An Act to vest power in the Water Corporation and the Water and Rivers Commission to make other provision in respect of their functions and for related and other purposes
Waterways Conservation Act, 1976	Department of Water	Protection of surface and groundwater

The proposal is also subject to the direction provided by the following State Government Policy documents.

- Department of Water (2008): *Statewide Policy on Water Conservation Efficiency Plans*
- Department of Water Identification (2007), assessment and protection of public drinking water source areas WQPN 87
- Department of Water, (2006) *Stormwater Management for Industrial Sites* WQPN 52

Other policies that are required to be consulted are:

Statewide policy no. 10 – Use of operating strategies in the water licensing process

Statewide policy no. 5 – Environmental water provisions policy for Western Australia

Statewide policy no. 16 – Policy on water conservation/efficiency plans

Statewide policy no. 19 – Hydrogeological reporting associated with a groundwater well licence

Statewide Policy No. 1 - Policy and Guidelines for Construction and Silica Sand Mining in Public Drinking Water Source Areas

2 Accepted and Best Practice for Hydrogeological Management in the Context of Mineral Sands Extractive Industry

A number of stages have been completed in the application for extractive industries license by Olympia Resources. These are a Public Environment Review, Public Environmental Review Response to Submissions, an Application for Approval to Commence Development and a Water Management Plan and an Acid Sulfate Soils Management Plan. Two groundwater assessments have been completed by Rockwater for Olympia resources.

These reviews, plans and assessments form part of the application process and will be interrogated as a review and critique of the specified documents. The detail of this critique is available as Appendix 1.

3 Key Findings

Stage 1 — Preliminary consultation

In this stage the proponent needs to consider the components of water management for the mining operation. The intent of preliminary consultation is to identify any critical issues that may prevent the project being approved and to ensure that the proponent understands:

From the available information it is unclear how much consultation was done at the stage of preliminary consultation and therefore this stage cannot be assessed. It is anticipated that preliminary consultation was done with Department of Water and others for this proposal however it is not necessary to document the consultation for the purposes of water use applications.

GHD GHD House 239 Adelaide Terrace Perth WA 6004 PO Box 3106 Perth Adelaide TCE WA 6832 Australia
T 61 8 6222 8222 **F** 61 8 6222 8555 **E** permail@ghd.com.au **W** www.ghd.com.au

Stage 2 – Scoping the Water Management Task

In this stage the proponent works with the Department of Water and other relevant agencies to determine the scope of investigations needed to inform the development of a complete application for a 5C licence to take and use water. Investigations are targeted to provide information needed to meet regulatory requirements and to meet local water management objectives and the mine water management objectives.

The scoping phase of the Water Management plan corresponds with the scoping document phase of the Public Environmental Review or Environmental Review and Management Programme administered by the Environmental Protection Authority.

A detailed assessment is available in Appendix 1 and only the most relevant issues are discussed below.

Water source options

This should include consideration of all the potential water sources (quantity and quality) for the project at mine operations.

Olympia has considered the use of groundwater, recycled water (86% of the total water requirement) and potable water sourced from independent commercial suppliers. Discussion was had on the surface water/streams in the area but it was not considered as a source option probably due to the environmental implications and the ephemeral nature of the watercourses. Desalination is unlikely to have been considered due to the distance from the ocean as well as the cost.

Water Access

The water access options for all sites at mine should be investigated.

There is no apparent evidence in the report about whether 26D licenses were obtained for construction of the new production or monitoring bores although the report is aware of the requirement to apply for licenses. 5C licenses will be required for utilisation of abstraction bores and dewatering if they have not already been obtained. Detail will have to be provided to Department of Water on the possible impacts of abstraction on the groundwater levels as well as the surrounding environment for the 5C license application if this has not already been done. There is very little information apparent about infrastructure pathways, pipeline and road impact on streams.

Fit-for-purpose water use

The proponent should investigate lower quality water use options for mine operations**.**

It is not apparent if any investigation of the possibility of lower quality water use was done at the mine site. In essence the dewatering water will be used because it is available and this will be supplemented by bores in the Leederville Aquifers. It is not known if there are any low quality waters within the area. Investigations should also consider minimum standards of water quality necessary for different purposes and infrastructure changes that could allow the use of lower quality water

Alternative sources

The proponent should investigate alternatives to the traditional surface and groundwater sources.

Alternative sources were investigated as per possible provision of potable water by a third party. Other non- traditional sources were not investigated. There is no apparent evidence of applications for 26D (license to construct) or 5C license to abstract or evidence of purchase of existing groundwater allocations (water trading).

Optimising water use

Proponent should investigate water optimisation options for mines with surplus water**.**

Investigation has focussed on reuse of water with approximately 86% of the water to be recycled. There is no apparent evidence that opportunities to supply a third party using possible surplus water were investigated. Opportunity for aquifer reinjection was not investigated. There is no apparent discussion of the water quality of potential surplus discharge water, about changes in the water chemistry during oxidation from dewatering or use of production groundwater obtained from the Leederville Aquifer and how the infiltration of this during backfilling of completed areas will impact on the receiving Superficial Aquifer chemistry. It was stated that adverse water quality (turbidity and acidity) would be managed before discharge.

Releasing water

Proponent should investigate the potential impacts of releasing water to the environment

The proponent appears to have not commented on likely areas of release, the flow regime of the receiving water bodies (although the hydrology of the major water courses is described there is no indication which ones would be the receiving water bodies,) any changes in water release through the life of the project or any specific effects except to say that there will be minimal impacts. It is not apparent if this covers the scale of the impact downstream, the ecosystem impacts and the cultural and social impacts of the release. The sensitivity of the receiving environment is also not detailed.

4 Draft Local Planning Policy No. 30 Mineral Sands Mining

The Shire of Serpentine-Jarrahdale Draft Local Planning Policy no. 30- Mineral Sands Mining (DLLP 30) is applicable to the proposal given the proposed use of the site.

Issues to be assessed for DLLP 30 with regard to groundwater are as follows:

Appendix B -6 The potential for the groundwater levels to be lowered in the local vicinity of the mining operations and the associated impacts including ecological, domestic, industry and rural use of this natural resource

Comment – As is discussed later in more detail the groundwater levels will be impacted in both the Superficial and the Leederville Aquifers over the life of the project. It is predicted in the reporting that recovery of the groundwater levels will occur after the project. It is not apparent if the cumulative impacts for both dewatering from the Superficial and abstraction from the Leederville Aquifer have been modelled.

Appendix B – 7 The potential for contamination of the groundwater in the local and downstream area of the mining operation

Comment- The proponent has put in place a Water Management Plan and Acid Sulfate Soils Management Plan with relevant trigger groundwater quality level triggers to manage the impact of pollution from contamination

Appendix B -8 The potential impacts on drinking water supplies

Comment – The proponent has said that there could be an impact on drinking water supplies in the vicinity of the mine particularly with regard to drawdown of groundwater levels that will occur. The proponent has proposed that contingency measures will be put in place to supplement water supply if this occurs

Appendix B- 9 The potential for the disturbance of the land to increase salinity and acidity in the surrounding water and soils

Comment- The proponent has put in place a Water Management Plan and Acid Sulfate Soils Management Plan with relevant trigger groundwater quality level triggers to manage the impact of salinity and acidity in the surrounding area.

Appendix B-10 The potential for short term, medium term and long term damage to the above ground and below ground stream zones and the natural aquifers

Comment- As is discussed later in more detail the groundwater levels will be impacted in both the Superficial and the Leederville Aquifers over the life of the project. It is predicted that recovery of the groundwater levels will occur after the project. The proponent has said that there could be an impact on drinking water supplies in the vicinity of the mine particularly with regard to drawdown of groundwater levels that will occur. The proponent has proposed that contingency measures will be put in place to supplement water supply if this occurs

Appendix B-11

The potential impact of acid sulphate soils, poorly structures soils, dispersive or sodic soils and potentially hazardous compounds.

Comment- The proponent has compiled an Acid Sulfate Soils Management Plan and undertaken an assessment of the soils in the mine area. The assessment of the whether poorly structures soils, dispersive or sodic soils have been investigated is beyond the scope of this brief .

5 General Comments

5.1 Groundwater Levels

There is a connection between the underlying Leederville and the Superficial Aquifer which is recorded in Rockwater Report (2007). Test pumping was analysed by Rockwater (2007) for bore KL3P. Water level effects of pumping were measured in the Superficial Aquifer at bore KWT3A during the pumping test of bore KL3P (a production bore located in the Leederville). A drawdown 0.04m was recorded in the Superficial Aquifer after 44 hours of pumping. The bore which is in the Superficial had just began to respond to the pumping of the Leederville Aquifer when the test ended which indicates delayed drainage from the Superficial Aquifer. Rockwater (2007) then states that for a pumping rate 1.6 times that of the test for 8 years (in the Leederville) it is extrapolated that there will only be an average drawdown of 0.06m/a at KWT3A in the Superficial Aquifer if there was no aquifer recharge.

This seems unlikely if the drawdown over 44 hours is already 0.04m in the Superficial Aquifer at a rate less than will be pumped during mining. It is not apparent from the reports if the groundwater model was recalibrated with this new information or a calculation done of the Kv (vertical hydraulic conductivity) for the area between the Superficial and the Leederville Aquifer in the model after this test pumping was done. This is important as it defines the connection between the two aquifers and influences the model greatly.

There is no apparent evidence what the cumulative impact of dewatering and rewetting of the Superficial Aquifer, abstraction from the Leederville and abstraction from adjacent landusers would have on the Superficial Aquifer to define the cumulative impact of pumping the bores in the Leederville Aquifer.

Rockwater (2007) also states due to abstraction from the Leederville ”there will be slightly less seepage into the existing drains/watercourses” but does not define what amount this is. This water is evidently derived from daylighting of groundwater into surface water courses from the Superficial Aquifer. This is a possible concern which should be investigated further.

5.2 Water Quality

Water from the Leederville will be used in the mining process. Rockwater (2007) says the water contains high levels of Total Iron up to 19mg/L and manganese up to 0.75mg/L. A large amount of this water will end up in the receiving water body of the Superficial Aquifer after removal of the ore.

It appears that there is no detailed analysis of Total Iron for the background water quality of the Superficial Aquifer in the mine area so it is difficult to assess if there will be any impact on the Superficial Water Quality through iron oxidation and deposition of this iron or other impacts through mixing of different water types.

The Manganese concentrations in the Superficial Aquifer are higher then the Australian Drinking water Guidelines (0.2mg/L and 0.5Mg/L) but the one Manganese value obtained for the Leederville Aquifer on site is even higher 0.75mg/L. This mixing may need to be further assessed to maintain the quality of the Superficial Aquifer which will have water from the Leederville disposed of in it..

5.3 Post Closure Landforms

The mining process will remove a certain percentage by volume of the mineral sands in and above the Superficial Aquifer.

If the mining does not return the landforms to previous elevations the groundwater levels when recovered could create seeps and wetlands through the area if they daylight. Even if the groundwater levels are within a certain distance from the surface there could be evaporation from the aquifer through capillary rise and evapotranspiration.

Any increased evaporation would impact on volumes in the Superficial Aquifer and although in general the impact may seem insignificant it can decrease volumes in the aquifer as well as increasing salts through evaporation.

6 Conclusions

In general the proponent has addressed most issues associated with the hydrogeology of the project.

The following items are not apparently addressed in the documentation.

1. Preliminary consultation with Department of Water
2. Obtaining required 26D license(to construct) and 5C licence (to abstract) which may require a more detailed evaluation of impacts on the aquifer
3. Addressing possible alternative water sources, low quality water sources, potential for purchase of existing abstraction licenses, fit for purpose assessment for production water
4. Apparent issues with the cumulative effects of impacts on the Superficial Aquifer through abstraction from the Leederville Aquifer, dewatering of the Superficial Aquifer for ore extraction, and other groundwater users in the area.
5. Apparent gaps in knowledge with regards to water quality of the Leederville and Superficial Aquifers in the mine area and an assessment of the cumulative quality impacts of mixing of both water resources during production and subsequent disposal in mine pits
6. Possible impacts of post closure landforms with regard to increasing evaporation from the Superficial Aquifer
7. Assessment of the sensitivity of the receiving water bodies during water disposal, likely areas of release, the flow regime of the receiving water bodies (although the hydrology of the major water courses is described there is no indication which ones would be the receiving water bodies,) any changes in water release volumes through the life of the project or any other specific effects.

7 Disclaimer

"This Hydrogeological Peer Review: Proposed Mineral Sands Mine report

1. has been prepared by GHD Pty Ltd for Shire of–Serpentine-Jarrahdale and

2. may only be used and relied on by Shire of Serpentine- Jarrahdale

3. must not be copied to, used by, or relied on by any person other than Shire of Serpentine-Jarrahdale without the prior written consent of GHD;

4. may only be used for the purpose of an Peer review assessment and must not be used for any other purpose.

GHD and its servants, employees and officers otherwise expressly disclaim responsibility to any person other than Shire of Serpentine-Jarrahdale arising from or in connection with this Report.

To the maximum extent permitted by law, all implied warranties and conditions in relation to the services provided by GHD and the Report are excluded unless they are expressly stated to apply in this Report.

The services undertaken by GHD in connection with preparing this report do not include GHD undertaking any site visits or testing that could have been undertaken.

The opinions, conclusions and any recommendations in this Report are based on assumptions made by GHD when undertaking services and preparing the Report.

GHD expressly disclaims responsibility for any error in, or omission from, this Report arising from or in connection with any of the Assumptions being incorrect.

GHD has prepared this Report on the basis of information provided by the Shire of Serpentine-Jarrahdale who provided information to GHD, which GHD has not independently verified or checked beyond the agreed scope of work.

GHD expressly disclaims responsibility in connection with the Unverified Information, including (but not limited to) errors in, or omissions from, the Report, which were caused or contributed to by errors in, or omissions from, the Unverified Information.

Regards

Bradley van Blomestein

Principal Hydrogeologist

Appendix 1 – Best Practice Assessment Review Checklist

A checklist has been adapted for Mining Applications as a basis for the best practice review. It includes alterations where necessary and may not include all relevant considerations.

Stage 1 — Preliminary consultation

In this stage the proponent needs to consider the components of water management for the mining operation. The intent of preliminary consultation is to identify any critical issues that may prevent the project being approved and to ensure that the proponent understands:

- the regulatory requirements for abstracting and using water
- the water volume and quality needs of the proposed operation
- the possible sources of water and their quantity and quality
- the legal requirements for access to water sources
- the needs of water dependent ecosystems within the project area; and
- the need for efficient use of water.

The proponent must also be aware of possible water quality issues and identify other operations which may affect the proposed mine, or be affected by it.

From the available information it is unclear how much consultation was done at the stage of preliminary consultation and therefore this stage cannot be assessed. It is anticipated that preliminary consultation was done with Department of Water and others for this proposal however it is not necessary to document the consultation for the purposes of water use applications.

Stage 2 – Scoping the Water Management Task

In this stage the proponent works with the Department of Water and other relevant agencies to determine the scope of investigations needed to inform the development of a complete application for a 5C licence to take and use water. Investigations are targeted to provide information needed to meet regulatory requirements and to meet local water management objectives and the mine water management objectives.

The scoping phase of the Water Management plan corresponds with the scoping document phase of the Public Environmental Review or Environmental Review and Management Programme administered by the Environmental Protection Authority.

A consideration of the detail in the applications made is considered below

7.1.1 Water source options

This should include consideration of the potential water sources (quantity and quality) for the project at mine operations.

Options include:

√ groundwater

√ surface water

√ recycled or reused water

√ excess dewatering water

X third party supply (from other mine operations)

X desalinisation

√ scheme water supply

√ a combination of the above.

Comment - Olympia has considered the use of groundwater, recycled water (86% of the total water requirement) , potable water sourced from independent commercial suppliers. Discussion was had on the surface water/ streams in the area but it was not considered as an option probably due to the environmental implications and the ephemeral nature of the watercourses. Desalination is unlikely to have been considered due to the distance from the ocean as well as the cost.

7.1.2 *Water Access*-***The water access options for all sites at mine should be investigated.***

The investigations should consider:

√ points of abstraction

X infrastructure pathways (pipeline and road impact on streams)

√ taking of water in water source protection areas

N/A native title for water access

√ national parks or conservation areas

√ potential monitoring sites

√ public water source protection areas.

Exploration for water sources

A *26D licence to construct or alter a well* is required for:

x constructing a bore or well

x preliminary monitoring bores.

There is no apparent evidence in the report about whether 26D licenses were obtained for construction of production or monitoring bores although the report is aware of the requirement to apply for licenses. Department of Water tends to be fairly lenient on this however it normally is a requirement. 26D and 5C licenses will be required for construction of abstraction bores if they have not already been obtained. There appears to be adequate groundwater allocation to obtain these. There is very little information apparent about infrastructure pathways (pipeline and road impact on streams).

7.1.3 ***Water source – Investigation of the sustainability of the water source options at mine operations.***

Investigations should consider:

√ local and regional hydrogeology and hydrology of sources

√ groundwater and surface water connectivity

√ recharge

√ reliability

√ water quality

√ impacts of abstraction regimes

√ minimisation of impacts

√ regulatory requirements for abstraction.

7.1.4 ***Fit-for-purpose water use - Investigate lower quality water use options for mine operations.***

Investigations should consider:

x minimum standards of water quality for different purposes

x infrastructure changes that could allow the use of lower quality water

x benefits such as security of supply and avoidance of adverse effects at other sources

√ the availability of water.

No investigation of any lower quality water use was done at the mine site. In essence the dewatering water will be used because it is available and this will be supplemented by bores in the Leederville Aquifers. It is not known if there are any low quality waters within the area and perhaps this was why it was not considered.

7.1.5 Alternative sources - Investigate alternatives to the traditional surface and groundwater sources.

Investigations should consider:

√ recycled water opportunities at all stages of the operation

√ suitability of non-potable supplies

√ possible provision by a third party

X legal arrangements (under the *Rights in Water and Irrigation Act 1914* and/or the *Water Services Licensing Act 1995*) for non-traditional water sources.

Alternative sources were investigated as per possible provision of potable water by a third party. Other non- traditional sources were not investigated. There is no apparent evidence of applications for 26D (license to construct) or 5C license to abstract

7.1.6 Optimising water use - Investigate water optimisation options for mines with surplus water.

Investigations should consider:

√ how to maximise on-site use (including dust suppression)

x opportunities for supply to a third party

√ aquifer re-injection/ infiltration (including suitability of the receiving aquifer).

Investigation has focussed on reuse of water with approximately 86% of the water to be recycled. No opportunities to supply a third party were investigated. Opportunity for aquifer reinjection were not investigated nor a study done on the receiving water body quality however infiltration back into the aquifer by recycling surplus water during backfilling of completed areas will occur. No apparent real discussion of the water quality of surplus water or about changes in the water chemistry during oxidation from dewatering or use of production groundwater obtained from the Leederville Aquifer and how this will impact on the receiving Superficial Aquifer are apparent. However it was stated that adverse water quality (turbidity and acidity) would be managed before discharge.

7.1.7 Water use efficiency – Investigation of the options for increasing the water use efficiency for the entire project.

Investigate the opportunities for water use efficiency at:

√ mine operations.

7.1.8 Water use efficiency- Investigate infrastructure methods to achieve water use efficiency.

Investigations should look at:

√ major infrastructure options

x phasing of different water use activities

√ engineering alternatives

√ alternative bore field configurations to minimise water wastage

√ minimising water use for dust suppression

√ use of mine voids for water storage.

Phasing of different water use activities was not discussed

7.1.9 Water dependent ecosystems- Investigate the occurrence of water-dependent ecosystems.

Investigations should consider:

√ identification of any water-dependent ecosystems

√ connectivity of water-dependent ecosystems to water resources

√ sensitivity to water level change

√ water level requirements

√ consultation requirements

√ ecological water requirements

√ summary of ecological water requirements.

7.1.10 Other waterdependent values- Investigate the occurrence and distribution of other water-dependent values.

Investigations should consider:

√ identification of cultural and social sites and values

√ any consultation required to identify the specific cultural and social values

N/A water levels or flows required to maintain those values.

7.1.11 Water quality impacts - Investigate the potential impacts on the water source water quality at mine.

Investigations should consider:

√ presence of acid forming material

√ baseline water quality of receiving water bodies

√ turbidity, salinity and acidity impacts

√ buffering and mitigation capacity of water bodies receiving acid water

√ designing baseline monitoring programs

√ defining water quality triggers for operations and emergencies

√ Guidelines for water quality during operations.

7.1.12 Water release options- Investigate the options for release of mine surplus water.

Investigations should consider:

√ re-use on site

√ relocation for use nearby

N/A aquifer pit storage

√ controlled discharge

√ catchment or aquifer modification

√ stream realignment.

7.1.13 Releasing water - Investigate the potential impacts of releasing water to the environment

Investigations should consider:

X likely areas of release

X receiving water body's water regime

X changes in water release regime throughout the life of the project

√ ecosystem impacts

√ likely stream morphology changes

X seasonal changes

√ flood events

X sensitivity of receiving water dependent environment

√ scale of impact downstream

√ cultural and social impacts of release.

The proponent appears to have not commented on likely areas of release, the flow regime of the receiving water bodies (although the hydrology of the major water courses is described there is no indication which ones would be the receiving water bodies,) any changes in water release through the life of the project or any specific effects except to say that there will be minimal impacts which possibly covers the scale of the impact downstream, the ecosystem impacts and the cultural and social impacts of the release. The sensitivity of the receiving environment is also not detailed.

7.1.14 Cumulative Impacts - Investigate the potential scale of cumulative impacts on the water regime that may occur as a result of the project.

Investigations should consider:

x multiple areas of potential abstraction

√ overlapping cones of drawdown

x dewatering discharge locations

√ distribution of ecosystems within the project area

The groundwater modelling has not taken into account the cumulative impacts of other users within the area which could add to the drawdown.

Dewatering Discharge locations are not detailed

7.1.15 Post-closure management

Proponent should Investigate the consequences of various post-closure water management options.

Consequences to consider:

√backfilling to watertable

√ regional aquifer and hydraulic connections

√ potential salinity impacts of mine void

√ rehabilitation water requirements and duration