NSW GOVERNMENT | Department of Primary Industries

OUT15/16957

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Dear Ms Donnelley

Balranald Mineral Sands Project (SSD_5285)
Adequacy of the draft Environmental Impact Statement

I refer to your email dated 1 June 2015 to the Department of Primary Industries in respect of the above matter.

Comment by DPI Water
DPI Water has reviewed the exhibited Environmental Impact Statement for the proposed Balranald Mineral Sands Project. The following key comments are provided with detailed comments in Attachment A, specific groundwater comments in Attachment B and recommended conditions of approval in Attachment C.

- The project consists of construction, open cut mining, processing and rehabilitation at the West Balranald and Nepean mineral sand deposits. The project has a 15yr mine life with the operational phase completed at West Balranald in Yr 9 and Nepean in Yr 8. Backfilling, rehabilitation and decommissioning would take the remaining years.
- Significant water management infrastructure is required including approximately 350 dewatering bores during the mine life, reinjection borefields, water storage dams, and a water pipeline to the Murrumbidgee River and associated pump.
- Operational average water demands include 690 ML/yr for dust suppression, 19345 ML/yr for process water and 15 ML/yr for workforce consumption.
- The project is dependent on the ability to dewater the aquifer at peak rates of 1300 L/s at West Balranald and 190 L/s at the Nepean deposit and to reinject this water into the same aquifer. The ability to manage potential issues such

as clogging of reinjection bores and the ongoing management of a large number of dewatering and reinjection bores is critical.

- Continued engagement with the NSW Office of Water is supported in terms of potential return flow regulations and accounting for the predicted ground water take.
- The impacts on groundwater level, groundwater pressure and water quality are not predicted to exceed the Level 1 assessment criteria of the NSW Aquifer Interference Policy. These impacts are deemed acceptable.
- The development of a water management plan to manage and monitor water impacts and to establish contingency and response protocols is supported.

Information requests

- Additional information is requested on the market depth to obtain the proposed 450 unit shares of high security entitlement in the Murrumbidgee Regulated River water source.
- Assess the potential impact on flooding of the proposed bund at the West Balranald deposit to prevent floodwater entering the mining area from Muckee Lake.
- Clarify how the use of the drain boundary condition in the model rather than actual dewatering wells in the numerical model appropriately accounts for the groundwater take from both the Shepparton and Loxton-Parilla Sands aquifers.
- Clarify the groundwater budget to explain how more groundwater is reinjected than extracted in years 5 and 6 of mining (Table 6.2).
- Assess the impact of applying the in-situ aquifer parameters to reflect post closure groundwater behaviour in the model. A specific uncertainty analysis should be conducted to identify the significance this assumption has on the post closure groundwater behaviour given that the material used to fill the void will have different hydraulic properties.
- Assess the risk of the West Balranald final mine void landform causing saline inundation of the depression or evapo-concentration of salts within the soil profile, due to the potential shallow depth of the groundwater level in the Shepparton Formation.

For further information please contact Tim Baker, Senior Water Regulation Officer (02) 6841 7403 or at Tim.Baker@dpi.nsw.gov.au.

Yours sincerely

Kristian Holz
Director Policy, Legislation and Innovation

Attachment A

Balranald Mineral Sands Project (SSD_5285)
Request for comment on adequacy of EIS
Additional comments by DPI Water

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1. Project Activities

- The project proposes extraction of mineral sands at the West Balranald and Nepean deposits via open cut mining methods. The West Balranald deposit is approximately 20km long located 50 to 80m below ground surface and the Nepean deposit is 8km long located 40 to 60m below the surface.
- Significant dewatering of the existing aquifer is proposed to enable operation of the open cut in dry conditions. This is proposed via approximately 350 dewatering bores over the life of the mine pumping at an average rate of 746L/s for the 6yrs of mining at the West Balranald deposit. Average dewatering rate at the Nepean deposit is predicted at 100L/s for the 1.5yrs of mining. Reinjection of the dewatered water is proposed into the same aquifer at on-path and off-path injection borefields.
- A pump and pipeline to extract water from the Murrumbidgee River is proposed to supplement water demands.
- New access roads are required for the project which includes an 18km road to the West Balranald site and a 39km road to the Nepean site. This will require crossing of drainage lines which will require crossings to be constructed.

2. Water Demands and Sources

- Water demands for the project include dust suppression, process water and workforce consumption. These demands are proposed to be addressed by a combination of water sources including extracted groundwater, the Murrumbidgee River via a pipeline and water trucked to site.
- The majority of water demands are proposed to be provided by the dewatered groundwater with the predicted dewatering volumes to be in excess of total demands for the project. Construction water is to be sourced from the Olney groundwater formation which is of better quality than the Loxton-Parilla Sands aquifer which will be the main supply during operations.
- Construction phase water demands include a total of 300 ML over three years. The operational phase average yearly water demands include 690 ML/yr for dust suppression, 19345 ML/yr for process water and 15 ML/yr for workforce consumption.
- The water balance completed for the project indicates adequate water availability to meet the predicted demands for all stages.

3. Surface Water Assessment

- The mine water management system will include a maximum catchment area of 194.3ha which represents less than 0.1% of the Box Creek catchment. No existing surface water users have been identified that could be potentially impacted.
- Appendix H indicates a final void is to be retained at the West Balranald mine site after mining completion and rehabilitation. This void is to be approximately 52ha in size and all runoff from adjacent lands is to be diverted away. The base level of the void is to be 52m AHD which is approximately 13.5m below existing ground levels and approximately 3m above the current groundwater level.
- No final void is to be retained at the Nepean mine site with backfilling to match surrounding ground levels.
- The EC of the water in the final void is predicted to start at approximately 43000 µS/cm when there is about 1 ML of water and then reduce to about 8500 µS/cm when the water volume exceeds 1 ML. Water in the void is predicted to either infiltrate into the underlying soil or evaporate. Runoff from a 1 in 100 year rainfall event is predicted to take approximately 5.5 weeks to completely dry out when there is ongoing rainfall or 2 weeks under average rainfall conditions.

4. Flood Assessment

- The flood modelling for at least a 1 in 100yr flood event indicates the West Balranald and Nepean mine infrastructure is located outside the Box Creek and Tin Tin Lake flood extent. Parts of the Nepean access road are to be within the modelled flood extent hence it may be inundated and inaccessible during such an event. This is displayed in Figure 5.3 of Appendix H. The Nepean access road is proposed to be constructed at ground level hence there is no predicted impact to flood levels, flood distribution or flood velocities. If the proposed construction changes, a flood impact assessment should be undertaken.
- Inundation of part of the West Balranald mining area is predicted due to floodwater backing up into Muckee Lake. A suggestion is proposed for a bund to protect the mining area from the floodwater, however no detail is provided on its design or potential impacts on flood distribution.
- Figure 5.3 also indicates the flood extent to be close to the location of the final void. Clarification is requested of the risk for the flood to enter the void and consideration of appropriate mitigation measures.

5. Groundwater Assessment

- Groundwater extraction for the project is to occur primarily within the Loxton Parilla Sands aquifer of the Western Murray Porous Rock groundwater source. The EIS indicates the water quality of this aquifer has an average EC of 56000µS/cm.
- Table 12.1 of Appendix K indicates dewatering to be 300 ML/yr during construction and increasing from 19546 ML in Mining Yr 1 to a peak of 29537 ML in Yr 6. This water is to be reinjected at either on-path or off-path injection borefield sites at a peak rate of 29616 ML in Yr 6. Dewatering and reinjection is predicted to cease after year 8 of the project.
- Reinjection from dewatering is proposed back into the same aquifer from which it was extracted at peak rates of about 1300L/s during mining and a total modelled injection volume of 148820 ML.
- Groundwater inflows to the West Balranald mine site are to be dewatered to the MUP dam at an estimated constant flow rate of 50 L/s (1577 ML/yr) over Years 1-4. No groundwater seepage into the pit is predicted for Year 8.
- The groundwater modelling for the West Balranald mine indicates a maximum drawdown of 2m to extend 5km into the Loxton Parilla Sands aquifer. A 0.2m drawdown is predicted to extend up to 15km in the Loxton Parilla Sands aquifer and 10km in the Shepparton formation during the 100yr post mining period. A predicted drawdown at the Nepean deposit of 0.2m is to extend 2km in the Shepparton and Loxton Parilla sands at the end of mining.
- Modelling indicates the groundwater level 100 years after mining will be 4.7m below the final void level and full recovery to pre-mining groundwater level is expected 110 years after mining. Section 14.4 of Appendix K indicates the final void is likely to increase recharge to the water table and cause slight mounding at this point. This increased recharge appears to be limited in extent and to not have any broader impacts based on the final groundwater level predictions. Table 12.1 predicts the recharge component of the groundwater balance is to reduce from 296ML/yr at pre-development to 286ML/yr hence further indicating limited potential for long term mounding impacts at the site.
- Mounding impacts modelled in the groundwater assessment indicate pressure heads in the Loxton Parilla Sands to increase by more than 5m above pre-mining levels and to increase by more than 2m in the Shepparton formation.

6. Aquifer Interference Policy

- The impacts on groundwater level, groundwater pressure and water quality are not predicted to exceed the Level 1 assessment criteria of the NSW Aquifer Interference Policy. These impacts are deemed acceptable.
- No high priority GDEs are listed in the WSP for the MDB Porous Rock groundwater source, and the two listed in the WSP for the Lower Murrumbidgee Groundwater Source are not predicted to be impacted by the project.

- An assessment has been completed on ecosystems that rely on groundwater but are not listed as high priority GDEs in a WSP. This assessment indicated the drawdown impacts on Black Box vegetation are rated as low near the West Balranald mine. The mounding impacts on Black Box vegetation near the injection borefield are rated as moderate with potential evidence for changing distribution of species and disturbance. Clarification is requested on the scale of low and moderate impacts on the vegetation and whether these impacts are permanent/temporary and if any mitigation measures or offsets are proposed.

7. Acid Mine Drainage

- Section 21 of the Main EIS details the highest risk acid mine drainage (AMD) potential sources for the project during the construction, operations and post closure/decommissioning stages. These mainly include the release of AMD runoff from stockpiled ore into the surface water and groundwater or from backfilling or dewatered in-situ material.
- An extensive list of management and mitigation measures are listed in Section 21.5 to manage the AMD potential for the project to what the EIS describes as a low risk. Ongoing monitoring and reporting will be critical to ensure these measures are adequate and to trigger the need for contingency response protocols.

8. Water Licensing

- Section 6.4.3 of the Main EIS indicates the proposal to obtain entitlement to account for the groundwater take via controlled allocation orders or third party water trades. These trades are proposed to be considered in terms of return flow regulations. As detailed in the EIS, return flow regulations are yet to be enacted hence the continued engagement with NSW Office of Water on this matter is required.
- Section 2.3 of Appendix K indicates the proposal to obtain 450 unit shares of high security water entitlement within the WSP for the Murrumbidgee Regulated River water source. No assessment is provided on the market depth to consider the ability to obtain this entitlement.
- The potential requirement for bunding to prevent floodwaters entering the West Balranald Pit may require a Part 8 approval under the *Water Act 1912* prior to construction.

9. Management and Mitigation

- A sediment and erosion control plan is proposed based on the Landcom 2004 and DECC 2008 guidelines. This is supported by the NSW Office of Water.
- Reinjection is proposed to be managed so the pressure in the Loxton Parilla sands is less than 3m below natural surface level or the surface of the pit. This is to minimise potential waterlogging and salinization impacts.
- Reinjection clogging is not predicted to be an issue provided the bores are screened only in the Loxton Parilla Sands aquifer and adequate well development is achieved. This is critical to the viability of the project hence must be managed closely.
- It is recommended road drainage crossings be constructed in accordance with the NSW Office of Water's "Guidelines for Controlled Activities on Waterfront Land".

End Attachment A

Attachment B

Balranald Mineral Sands Project (SSD_5285)
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1. Potential impacts

The potential groundwater impacts of the dewatering and reinjection of groundwater from the Loxton Parilla Sands aquifer include:

- Changes in groundwater quality due to acid and metalliferous drainage
- Changes in availability to water by groundwater dependent ecosystems (GDEs)
- Changes in access for adjacent groundwater resource users
- Increased leakage from the Murrumbidgee River and Murray River to the groundwater system.

2. Groundwater impact assessments

The environmental impact statement includes an assessment of:

- The groundwater level impacts (Appendix I),
- The groundwater dependent ecosystems (Appendix J),
- The geochemistry (Appendix Q), and
- The water management (Appendix K)

3. Groundwater level impacts

A numerical groundwater model has been prepared to assess the potential impacts of the dewatering of the mine void and aquifer reinjection (Appendix I).

The numerical model was built to a class 2 classification as specified by the Australian Groundwater Modelling Guidelines, which is appropriate for the assessment of this development. The supporting information, conceptualisation and model design is appropriate for this classification. As identified by the independent review by Hugh Middlemis, it failed to strictly meet the requirements of a Class 2 model mainly due to the use of steady state calibration. However, due to the level of information used there is sufficient confidence in it being deemed a Class 2 model.

The independent review by Hugh Middlemis identifies uncertainties associated with river leakage and boundary flow values. These are small values relative to the modelled water balance volumes. However, it is still a significant issue that should be addressed through further investigations of the model conceptualisation, assumptions and hydrogeological parameters. The changes in river leakage may require the proponent to acquire additional regulated river shares to account for river losses.

The actual dewatering bores at the West Balranald deposit are proposed to target the Loxton Parilla Sands (LPS) aquifer. The overlying Shepparton Formation is not directly connected due to the presence of a confining clay layer between the aquifers. The dewatering of the mined void at West Balranald was modelled using a drain boundary condition to all of the Shepparton Formation and LPS layers in the model.

It is uncertain if this approach accurately reflects the proposed dewatering of the mine void by the construction of dewatering bores in the LPS. If a confining layer is present between the Shepparton Formation and the underlying LPS it is likely that when actual dewatering occurs that there will be some retained water in the Shepparton Formation. This may be a source of variation in the modelled versus actual take of water from the water source, the significance of this factor is uncertain.

A model scenario run which includes the use of dewatering bores rather than a drain boundary condition would confirm the influence of the confining layer between the Shepparton Formation and the underlying LPS. The presence of the layer may prevent the complete dewatering of the Shepparton Formation and influence the predicted groundwater take.

In the reinjection borefield, the model assumes that reinjection occurs into the highly transmissive LPS surf zone and that this is present throughout the area. Additional investigations are required to confirm

the hydro stratigraphy of the reinjection borefield, the ability to achieve the assumed reinjection rates and the modelled groundwater level impacts.

The independent review by Hugh Middlemis also identifies that in-situ aquifer parameter were used to model post closure behaviour, which is likely to over-estimate aquifer recovery rates and groundwater levels and a specific uncertainty analysis was recommended.

4. Water Management

The proposed development is within the Western Murray Porous Rock water source. The proposed take is anticipated to peak at 29,537 ML/yr in year 6 of mining, which is within the long term extraction limit of the water source.

The development will be required to obtain sufficient shares and/or allocation from the market or through the release of entitlement through controlled allocations orders to meet its peak annual demand requirements.

The proponent will be seeking credits for the injected water under the return flow regulation once it is enacted and has assumed on this basis that only the difference in volume between the net and gross take will need to be held as entitlement. The ability to obtain this entitlement to account for the annual groundwater take and the enactment of the return flow regulations is yet to be confirmed, hence is a potential risk for the development.

4.1 Aquifer interference

Under the Aquifer Interference Policy, the Western Murray Porous Rock water source in the vicinity of the development is classified as a less productive water source due to the groundwater salinity being greater than 1500 mg/L.

The numerical groundwater model assessment and predictions of groundwater quality impacts identify that the proposed development is consistent with the Level 1 minimal impact considerations of the Aquifer Interference Policy for less productive porous rock water sources.

4.2 Water balance

The mine water balance for groundwater is based on the results from the groundwater numerical model. In years 5 and 6 the volume calculated to be reinjected slightly exceeds the annual take (eg. In year 6, 29,537 ML is extracted and 29,616 ML injected, hence an additional 80 ML is reinjected than was extracted). The net take from prior to year 5 is insufficient to account for the additional water being reinjected. This is based on the water balance figures supplied in Table 12.1 in Appendix 6. Additional explanation is required to explain the deficit in the water groundwater budget.

5 Groundwater dependent ecosystems

The groundwater salinity in the development and the area potentially influenced by groundwater dewatering and injection is highly saline and the pre mining groundwater levels are relatively deep (>10m below ground surface).

The groundwater dependent ecosystem assessment (Appendix J) rated the impacts as potentially low from the dewatering of the West Balranald deposit on adjacent Black Box vegetation. This is due to these woodlands only potentially accessing the saline groundwater during periods of the lack of the availability of soil moisture during drought conditions. It is anticipated that there will be no significant change in vegetation distribution caused by the dewatering activities.

Black Box vegetation in the vicinity of the reinjection bore field is rated as being moderately impacted, which may cause some evidence of changing of species and distribution.

6. West Balranald final void

The rehabilitated final void for the West Balranald deposit is anticipated to be about 13m below the pre-mining surface level; which is within 3 to 3.5m of the pre-mining groundwater level in the Shepparton Formation.

There is the potential that during periods of above average rainfall that the water table or capillary fringe of the Shepparton Formation may cause water logging or inundation of the final void area with saline water. This may lead to evapo-concentration of salts within the soil profile and impact on the long term viability of vegetation within the rehabilitated void area.

7. Geochemistry

The potential impact on the groundwater quality is from potential acid and metalliferous drainage (AMD) caused by sulphide oxidation of mined materials.

At the West Balranald deposit, organic overburden material was identified as a potential source of AMD. This material is proposed to be backfilled into the mined void below the (natural) groundwater level. It is anticipated that without any mitigation measures there is the potential for AMD to impact on the groundwater quality within the mine site. This impact is anticipated to be minimal due to the hydraulic gradient being towards the pit due to dewatering operations.

The proposed mitigation measures to prevent and minimise potential AMD from the organic overburden include:

- Directly placing the material as low as possible in its final storage location within the pit.
- Capping the material as soon as possible, and
- Blending or applying limestone to the material minimise the generation of AMD.

At the Nepean deposit, AMD is not anticipated to be generated based on limited information. The assessment recommends further geochemical assessment to confirm this assumption.

End of Attachment B

Attachment C

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RECOMMENDED CONDITIONS OF APPROVAL

- The proponent must obtain the necessary water licenses for the project under the *Water Act 1912* or *Water Management Act 2000* prior to commencement of activities.
- Additional geochemical assessment shall be undertaken at the Nepean deposit to confirm the initial assessment that no AMD will be produced at the deposit.
- Additional field investigations shall be undertaken within the reinjection bore field to confirm the assumed behaviour of the LPS aquifer (presence of highly transmissive LPS surf zone) and groundwater level impacts.
- A review of the numerical model shall be undertaken following the 1st year of mining to assess the model conceptualisation, hydrogeological parameters and water balance.
- The Proponent shall develop a Water Management Plan for the project. This Plan must be developed in consultation with the Office of Water and include:
  - details of water use, metering and water management on site,
  - details of water licence requirements,
  - Surface Water Management Plan, and
  - Groundwater Management Plan.
- The Surface Water Management Plan must include:
  - a program to monitor:
    - surface water flows and quality,
    - surface water storage and use, and
    - sediment basin operation,
  - sediment and erosion control plans,
  - surface water impact assessment criteria, including trigger levels for investigating any potentially adverse surface water impacts, and
  - a protocol for the investigation and mitigation of identified exceedances of the surface water impact assessment criteria.
- The Groundwater Management Plan must include:
  - baseline data on groundwater levels and quality,
  - a program to monitor groundwater levels, groundwater quality, groundwater take, groundwater reinjection and groundwater dependent ecosystems (frequency, sites, methodology, data collection and data management),
  - groundwater impact assessment criteria, including trigger levels for investigating any potentially adverse groundwater impacts,
  - a protocol for the investigation and mitigation of identified exceedances of the groundwater impact assessment criteria.
  - a protocol for periodic review of groundwater model calibration and verification of groundwater take and reinjection predictions and groundwater impacts.

End of Attachment C